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HOW HAVE UNIVERSITIES SURVIVED FOR NEARLY A MILLENIUM

David M. Cutler
Edward L. Glaeser

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How Have Universities Survived for Nearly a Millenium
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ABSTRACT

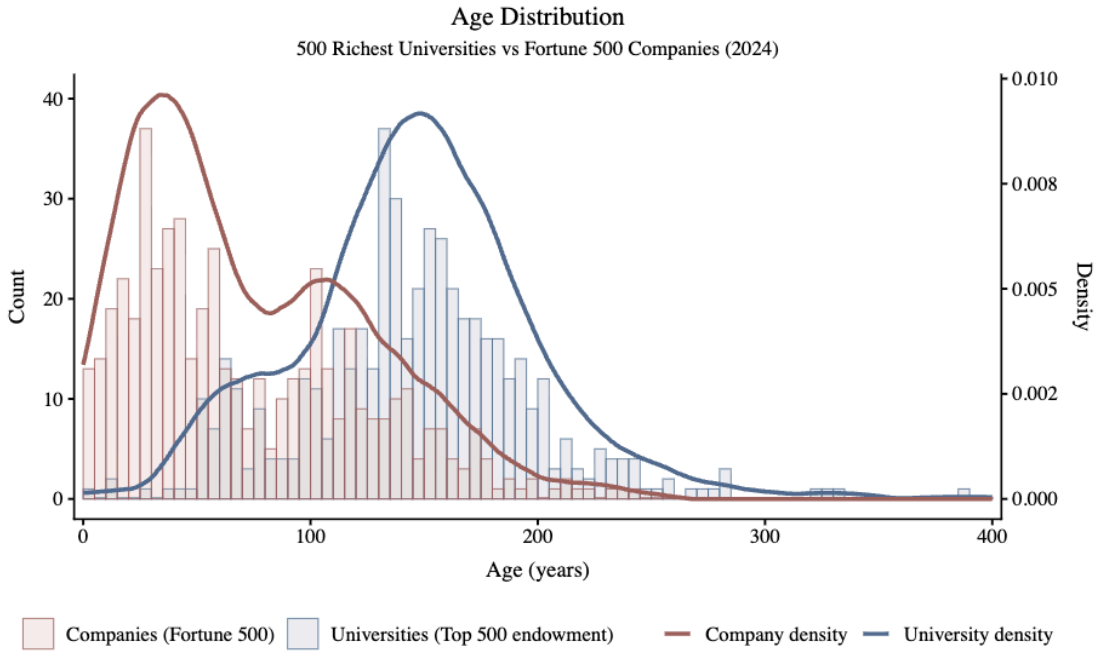
How have universities managed to survive and evolve over almost 1,000 years to become wildly heterogeneous, unusually fractious, multi-product, non-profit entities? Universities began as teachers' guilds, and they still give faculty a remarkable degree of autonomy. That structure attracts and empowers intellectuals, who are selected in part on their taste for knowledge, and those entrepreneurs and philanthropists have enabled universities to morph in ways that firms rarely do. Intellectual autonomy can also explain why universities are so often at odds with legal authorities and why faculty fight so often with each other and with their bosses. This essay presents a model of university organization and sketches the evolution of the university's products and conflicts over the last 900 years. We also discuss the social value of university education.

David M. Cutler
Harvard University
Department of Economics
and NBER
dcutler@harvard.edu

Edward L. Glaeser
Harvard University
Department of Economics
and NBER
eglaeser@harvard.edu

I. Introduction

Universities have not only survived but thrived for almost 1,000 years. Figure 1 shows the age distribution of 2024 Fortune 500 Companies and of the 500 American universities with largest endowments. About 98.6 percent of these universities, but only 57.2 percent of the top companies, are over 50 years old. Higher education has taught hundreds of millions, produced rivers of innovations, and branched into related services ranging from hospitals to athletic franchises. While only seven percent of scientific Nobel laureates have come from the private



Sources: Integrated Postsecondary Education Data System (IPEDS), 2024 Fortune 500 list, and data generously provided by Professor Yueran Ma.

sector, seventy percent have been academics (Zhang and Zhang, 2023). How have universities not just survived but thrived for so long?

In this paper, we argue that research universities have a special organizational structure that enables survival through reinvention, by wedding the guild-like structure of a professor's cooperative with an independent corporate entity that guards the university's capital. This

structure balances incentives for teachers and donors and helps attract scholars who have an appetite for learning and discovery.[1] This structure also explains why university faculty have been fighting fearsomely for centuries with school administrators, external authorities, and each other.

The university's hybrid control is as old as the university. Medieval teachers formed local guilds, later to become universities, and then donors created independent entities to guard their gifts. This structure arose by happenstance. However, Section II notes that it has many strengths. Faculty autonomy means that elite college professors more often resemble intellectual entrepreneurs than paid staff. Universities attract those with a taste for learning, discovery, and independence, of which there is plentiful supply. Faculty independence also explains why faculty engage in public criticism of university and political leadership in a way that is unimaginable in any normal firm.

At the same time, the existence of a non-faculty capital-controlling entity in turn enables innovation in the university model.[2] In Sections V and VI, we note that donors, students, and governments, not faculty members, played an outsized role in getting universities into the business of residential housing, athletics, and big science.[3]

Section III of the paper provides a statistical overview of American universities today. Virtually all of the 3,927 universities in the US teach. Five percent have "very high research spending and doctoral production." Unlike teaching, funded research is concentrated in a small number of universities. Housing is provided to all students at universities with a residential

[1] McLeod and Urquiola (2021) provide a complementary analysis of incentives within the university to produce research. Their focus is more on why American universities are different from universities in other countries. Our focus is on how universities are different from other organizational forms.
[2] As in Hart and Holmstrom (2010), there are a multitude of stakeholders in universities – students, faculty, administrative staff – and control rights are often unclear. Indeed, the premise of Henry Rosovsky's "The University: An Owner's Manual" is that the number of people with an ownership stake in a university is immense.
[3] Goldin and Katz (1999) describe the tremendous innovation between 1890 and 1940.

college model and for some students at many other institutions. Private schools provide much more housing than their public counterparts, which specialize in teaching and research. Across schools, there is a strong negative correlation between students per faculty and the share of spending on residential services.

In Section IV, V and VI, we provide a historical overview of how universities became multi-product firms. Section IV focuses on the 12th century origins of European universities, which begin as agglomerations of teachers that organize themselves into guilds. Guilds of teachers (and sometimes students too) reduced competition and lobbied for political rights. Certification is a natural outgrowth of teaching, and university degrees evolved from a local license to a more widely accepted license to a general signal of learning.

Section V turns to residential services, which began in Paris in 1250. Living together complements teaching because of the intellectual spillovers that come from physical proximity. Providing housing was particularly important in English and American colleges that were far from major population centers. In France and America, distinct non-faculty entities were established to maintain control of the physical capital involved in housing. As Gilded Age philanthropy massively increased the scale of college building, the relative power of boards and leaders increased. Faculty backlash ensued. The early 20th century battles between faculty and university presidents ended in a draw where faculty got tenure but administrators retained control over university endowments. Athletics were a tail on the dog, largely student-driven addition to the University portfolio during the same time-period.

Section VI examines the expanding role of research in top universities. University professors have always been scholars; learning is a complement to teaching. The big changes in scientific research occurred with teaching laboratories, which were invented early in the 19th

century, and grew with US federal funding of university research during and after World War II. the faith placed by the government in university-based research seems well-rewarded. Considering just health impacts, the return to university research far exceeds all federal spending on university research.

II. The University's Organizational Form

In this section, we first present our organizational definition of a university, which emphasizes faculty autonomy and a structure for protecting university capital from faculty expropriation. We then discuss how this structure relates to the research process. We end by discussing the tradeoffs as authority is shared between faculty and the capital-protecting entity.

The Organizational Model of the University

In 1970, former Harvard President James Conant wrote "We must never lose sight of two historical facts: one, the origin of the universities as independent guilds of master or masters and students; the other, the apparent necessity of counterbalancing the inherent freedom of action of these guilds by some outside force" (Conant, 1970). Conant's words mirror our definition of the university organizational model as a 'professors' cooperative' coupled with an entity that has control over the university's capital. In some cases, faculty do also have ownership over the capital-controlling entity, as physicians do in the Pauly and Redisch (1973) model of the not-for-profit hospital as a 'physician's cooperative.'[4] Most of the time, however, capital is

[4] In Pauly and Redisch (1973), the cooperative must rent capital and hence there is no need to protect capital against expropriation. Moreover, unlike Newhouse (1970), who focuses on hospitals' multiple objectives, Paul and Redisch assume a common profit-maximizing objectives. Universities both have abundant fixed assets and few universally shared objectives.

controlled by the university's top administrators, who are overseen by one or more boards, which as Conant writes, "counterbalance the inherent freedom of actions of these guilds."[5]

This definition excludes any school in which faculty are employees with no implicit or explicit rights beyond the usual workers' rights. It also excludes many religious teaching organizations, such as medieval monasteries, in which the leader has essentially absolute control over the faculty. The typical bundle of faculty rights includes an implicit or explicit right of employment, control (within limits) over class materials, and freedom to study whatever they want (within limits) in the time that is not spent teaching.[6] Other rights, including who gets to join the faculty, are typically shared in some fashion between the faculty and the capital-protecting entity.

The institution of tenure plays a particularly important role in transforming faculty from standard employees to quasi-independent intellectual entrepreneurs. Tenure allows scholars to take risks in the research, and provides incentives for early career scholars (MacLeod and Urquoila, 2021). Carmichael (1988) argued that tenure also encourages faculty to hire other good faculty without fear of losing their position to them..Finally, tenure also guards faculty against *ex post* appropriation of school-specific investment by administrators. Tenure enhances discord, however, allowing faculty to loudly air opinions that may be damaging to the larger institution.

[5] In Medieval Europe, universities were often controlled by the King. Gifts to medieval Islamic schools were similarly managed by a foundation or Waqf that was distinct from the teaching faculty. Harvard College was founded with a 400 pound gift from the Massachusetts' colonial legislature in 1636. That gift was initially overseen by a committee that included Governor Winthrop, and that oversight was formalized in 1642 when the legislature established the Board of Overseers, which still exists today.

[6] This description also captures most public school teachers in the U.S., but they typically have much less interest in or time for research.

As we discuss in later sections, the university's hybrid organization emerged in stages over the past millennium. Tenure is surprisingly recent – from the 1940s and 1950s – though teaching and research rights have been around for centuries.

The durability of this hybrid structure, and its appearance even in institutions that were initially donor controlled, suggests that it has strengths. The presence of a capital-protecting entity helps to convince donors to contribute to the institutions. In the next sub-section, we will discuss the consequences of faculty autonomy. We then turn to the balance of control between faculty and the capital-protecting entity.

Independent Scholars and The Utility from Learning

Almost two centuries ago, Jasper Adams, President of the College of Charleston, noted that "[n]o college in this country has permanently flourished, in which the trustees have not been willing to concede to the faculty, the rank, dignity, honor and influence, which belong essentially to their station" (Adams, 1838). Often, that honor consists of the ability to generate new knowledge, which is particularly valuable to scholars with a strong taste for discovery.

Scholars have noted their hunger for knowledge for millennia, and a large psychological literature now documents that curiosity is a persistent trait with substantial heterogeneity across individuals (Naylor, 1981, Reio et al., 2004, Sternszus, Saroyan and Steinert, 2017). Europe's ur-Professor Pierre Abelard wrote around 1130 that "I was so enthralled by my passion for learning that, gladly leaving to my brothers the pomp of glory in arms, the right of heritage and all the honours that should have been mine as the eldest born, I fled utterly from the court of Mars that I might win learning in the bosom of Minerva" (Abelard, 1132). Justus Liebig, the 19th century inventor of the teaching laboratory, wrote that he "in his childhood, read the books which

guided [his Father] in his experiments and such a passion for these books was gradually developed in me that I became indifferent to every other thing that ordinarily attracts children" (Liebig, 1880). The 20th century British biologist Peter Medawar noted that "Men or women who go to the extreme length of marrying scientists should be clearly aware beforehand, instead of learning the hard way, that their spouses are in the grip of a powerful obsession that is likely to take the first place in their lives."[7]

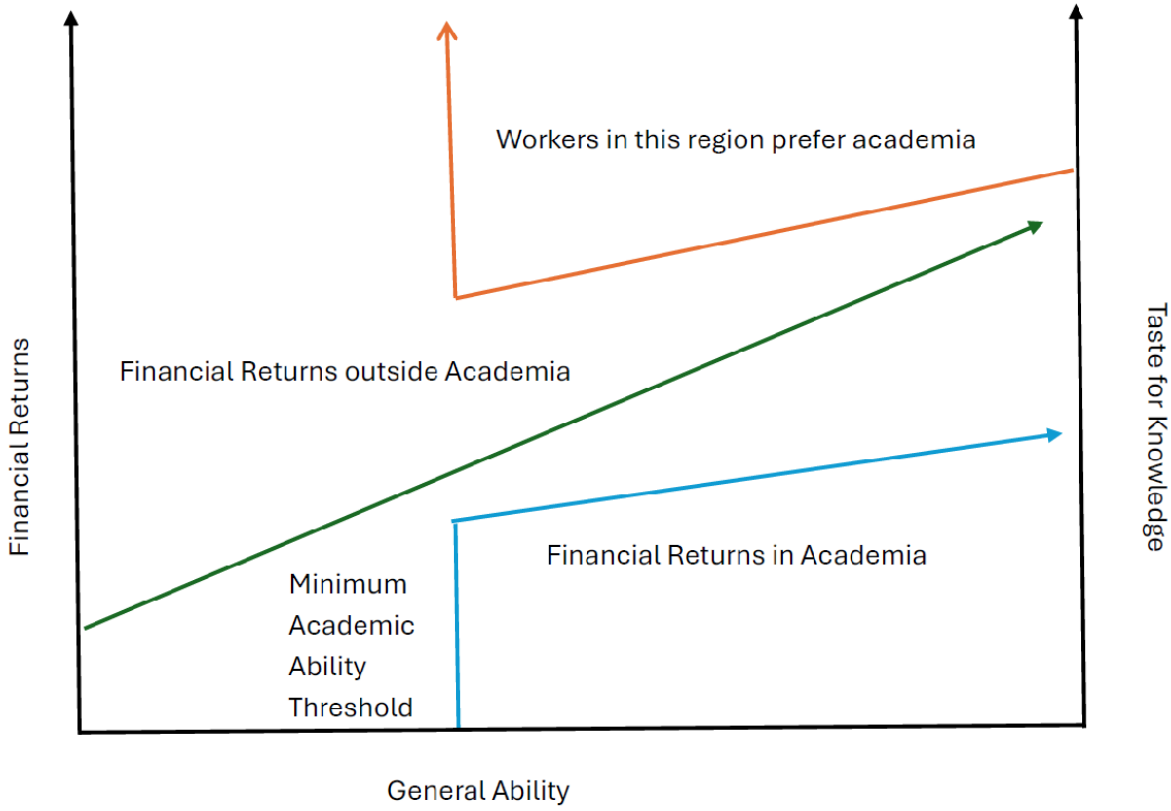
Autonomy is central for those with a taste for learning, especially since that taste may be targeted towards particularly idiosyncratic puzzles. The psychologist George Lowenstein notes that "curiosity tends to be highly transient, but at the same time, quite intense." The intellectual obsessions of faculty may not be explainable to or understandable by university management in a timeframe that satisfies an "intense" but "transient" curiosity.[8] A for-profit laboratory will presumably only undertake projects in which financial return exceeds the opportunity cost of the researcher's time. An autonomous academic lab can weigh both financial returns and scientific interest, which is presumably related to curiosity-related preferences of the principal investigator.

Consequently, scholars driven by a strong taste for discovery will sort into academia, which is illustrated in Figure 2. General ability is captured by the x-axis. The left hand y-axis captures financial returns. The green line shows the returns to ability outside of academia, and the blue line shows the returns to ability in academia. While there is a minimum ability threshold for teaching in a university, the returns are lower in academia and they rise more slowly with ability. We see this as an equilibrium phenomenon: academics are compensated for lower wages by having their curiosity sated.

[7] Lowenstein (1994) notes that "curiosity has been consistently recognized as a critical motive that influences human behavior …. at all stages of the life cycle." Moreover, a taste for learning appears to predict good academic outcomes (Chamorro-Premuzic, Furnham and Ackerman, 2006, Richards, Litman and Roberts, 2013).

[8] While it is possible to imagine non-autonomous employees striking Coasean bargains with their bosses whenever they want to pursue a question without an obvious financial payoff, such a system seems full of implementation difficulties especially given the impatience to learn suggested by the Lowenstein quotation.

The right-hand y-axis captures heterogeneity in the level of curiosity across individuals. People with more curiosity sort into academia because academic autonomy enables them to study whatever they want. The selection on curiosity because more extreme as ability rises, because they financial cost of being an academic also rises with ability.



The strength of the university's organizational form lies in its ability to attract and empower curiosity-driven people.[9] The weakness of that form is conflict that is inevitable in a hybrid organization that pits faculty against the trustees of the institution.

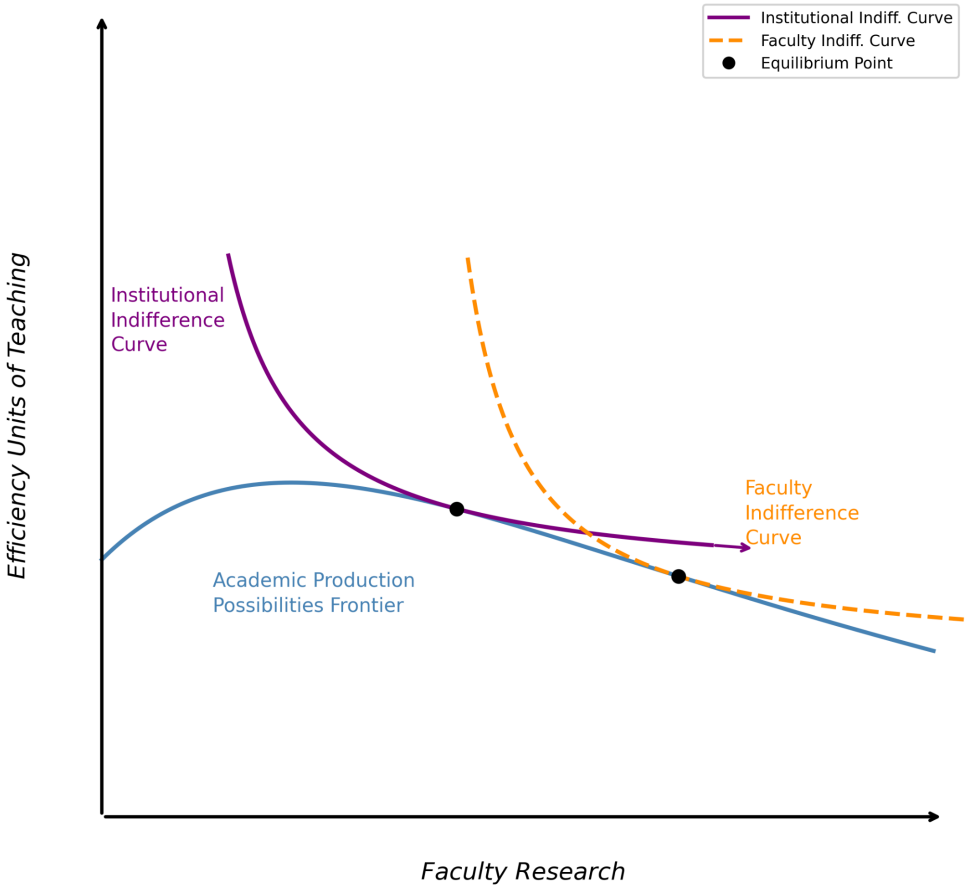
The Complementarity between Teaching and Research

[9] There are settings in which a passion for knowledge may push a scholar out of academia into a well-funded private company, such as Bell Labs or one of the current tech companies, if demands for specialized equipment or colleagues are sufficiently high. These cases are relatively rare and, even in these fields, there are plenty of top scholars who still prefer the less-funded autonomy of academia.

The joint production of teaching and knowledge accumulation make sense because there is complementarity between teaching and knowledge accumulation at least over some range, which is shown in Figure 3. The blue line shows the production possibility frontier. At low levels of research, the two activities are complements, as knowledge improves teaching.[10] At some point, the benefits of research for teaching reach diminishing returns, as time spent in research takes away from time in the classroom. In the pre-modern university, when teachers were typically compensated directly by students, the larger organization is not hurt when a scholar chooses to do relatively little teaching. Indeed, the other teachers benefit from the reduced competition. In the modern university, however, when students pay the school, then there is a conflict between teachers and the institution.

The institution internalizes the added revenue associated with more teaching. The teacher does not, at least in the short run, if her salary is independent of how much effort she puts into her classes (at least in the short run). The two indifference curves in Figure 3 show the preferences over research and teaching for a faculty member and a university administrator for research relative to teaching. The amount of teaching is relatively more important for (at least some of) the institution's customer base, which includes both students and donors.

[10] This is especially true when teaching involves embedding students in the research process, a trait that goes back two centuries.



Battles for Control

Autonomous, tenured faculty can lead to intra-faculty harmony or strife or both. C.S. Lewis (1960) discussed the deep friendships that can emerge through a common quest for knowledge. Henry Kissinger famously about faculty fighting.[11] We see intra-faculty rivalry as being far less consequential for the organization of the university than the conflict between faculty members and university administrators, which can concern everything from whom to hire to investment practices of an endowment.

[11] In C.S. Lewis' (1960) discussion of friendship, he emphasizes "the common quest or vision which unites Friends," and that the friendships occur when friends are "doing something together, but something more inward, less widely shared, and less easily defined; still hunters, but of some immaterial quarry." On the other side, Henry Kissinger famously opined that "the reason that university politics is so vicious is because stakes are so small."

Figure 4 demonstrates the allocation of decision rights within the university; the algebra associated with the figure and remarks we make is in the online appendix. We assume that empowered faculty cannot commit not to direct past donations towards their preferred activities, while administrators can make such a commitment.[12] When administrators have a great deal of authority, they may undo faculty investments, by closing a faculty member's laboratory or firing the faculty members. These assumptions imply that donors are more generous when the administration is in control, because the administration delivers a product that is closer to their preferences. Faculty, however, make more institutional investments of their own when they have more power.

The institutional possibility frontier is shown in the red line in Figure 4, which moves from strong executive control to faculty democracy. As the frontier moves from empowered presidents to empowered faculty, there is a tradeoff. An empowered president will find it easier to commit to external stakeholders, but strong executive control will limit the ability of faculty to benefit from their institutional investments.[13] The green university isoquant combines faculty inputs and donations to create total output.

[12] In practice, this commitment can take the form of having a university president who is trusted by the donor community.

[13] It is less obvious that faculty salaries go up with faculty control, as workplace control is an amenity that may come with lower wages (see Glaeser, 2005).

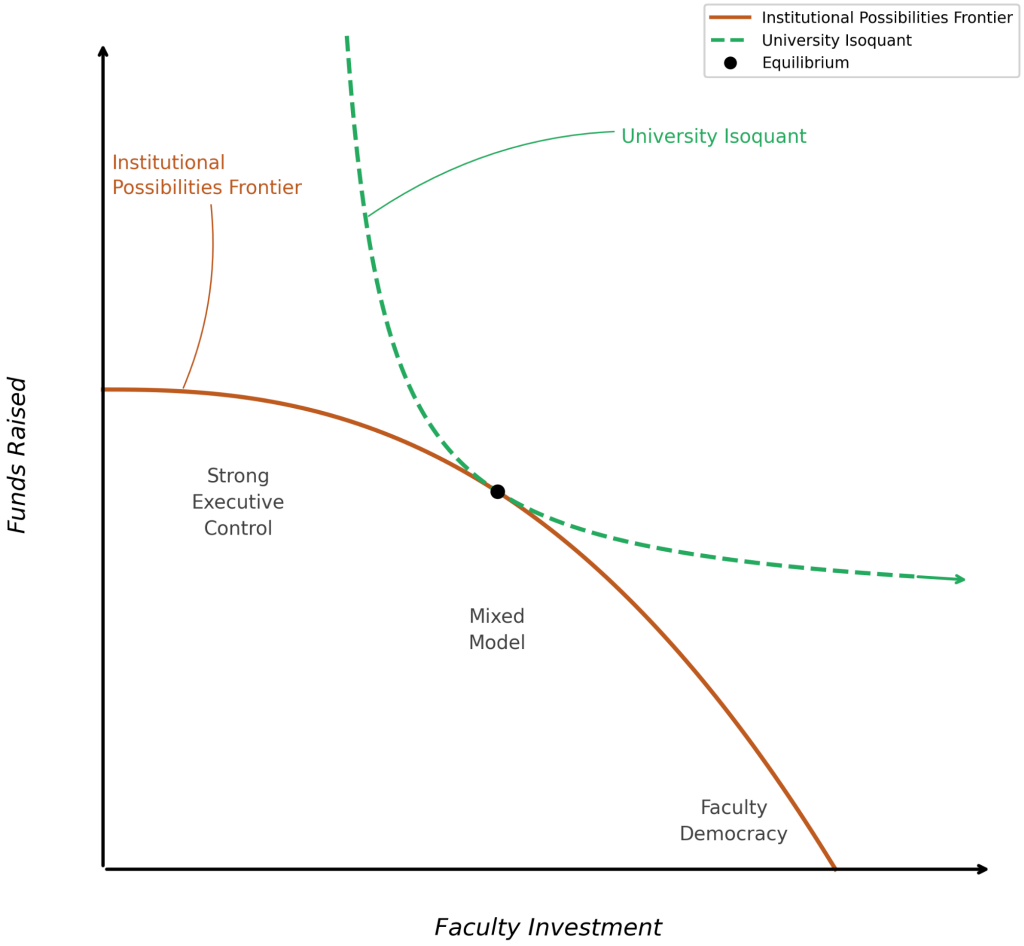
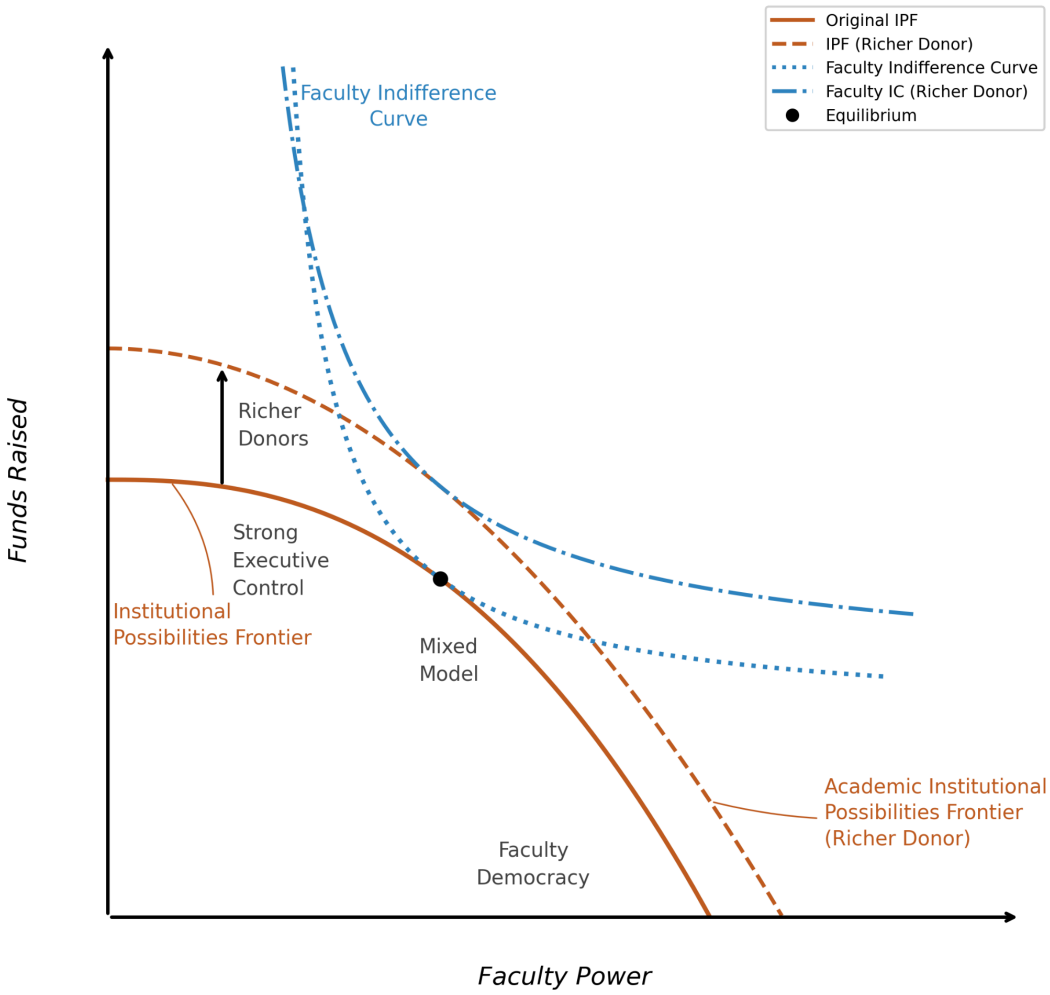


Figure 5 shows how the institutional possibilities frontier can shift following an increase in donor wealth and generosity. This shift pulls the curve upward; at any level of faculty involvement, more can be raised externally. In this case, we replaced the university isoquant with the indifference curve for a representative faculty member, who values both her own autonomy and donations. The upward shift in the possibilities frontier is also associated with a change in the indifference point, and we have illustrated a case in which the faculty member wants to cede autonomy to attract more gifts.



The late 19th century was a time of great philanthropy that accompanied great inequality, and not surprisingly, this coincided with an epoch of particularly empowered US university presidents, such as Charles W. Eliot of Harvard (president from 1869-1909), Timothy Dwight of Yale (1886-1899), Woodrow Wilson of Princeton (1902-1910), Nicholas Butler of Columbia (1902-1945), and James Angell of Michigan (1871-1909).[14] In some cases (such as Harvard), the faculty seem to have acquiesced in the increase in presidential power. In other cases (such as Columbia), they did not.

[14] In contrast, Oxford and Cambridge have large faculty control because of their very old endowments.

From a faculty member's perspective, ceding control makes the most sense when the ratio of potential new gifts to existing capital is high. Consequently, the asset-market base growth of university endowments should induce faculty to want more control. The extremely old endowments of Oxford and Cambridge may explain why faculty control is particularly strong in their residential colleges. In these entities, faculty elect their leader and choosing their own members.[15]

III. A Statistical Overview of American Academia

We now survey the landscape of American universities, before discussing how universities evolved over centuries. We use data primarily from the Independent Postsecondary Education Data System (IPEDS), which we supplement in several ways. Data on students are generally from 2018 – pre-pandemic – while data on expenditures are typically from 2024, but few of our conclusions depend on the exact time periods.

We divide universities into four tiers, following the Carnegie Classification of Higher Education (Gunja and Gast, 2025). Table 1 shows information about each tier. The first tier is the 69 research universities that are part of the Association of American Universities (AAU), which represents particularly elite and wealthy schools, including most of the Ivy+ colleges, and a number of prominent states schools such as the University of Michigan, the University of Arizona, and several University of California schools. The second tier includes the 118 remaining schools that are also rated R1, indicating "very high research spending and doctoral production," by the Carnegie Classification. The third tier includes the 2,335 non-R1 four year

[15] In the early centuries, Oxford colleges were typically subject only to the light oversight of the "visitor," while "Colleges in Paris" would "only occasionally chose their own head of house and they seldom elected to vacancies in the community." Instead, "The principal and *boursiers*, as they became known, were appointed by the college visitor or, in the second case, whoever the founder of the scholarship had designated should have the right to nominate."

institutions.[16] The fourth tier includes 1,405 community colleges. In some cases we group tiers 1-3 together, but separate private and public institutions.

Broadly, the university tiers do different things. Tier 4 schools are primarily in the teaching business, providing pre-professional and pre-four year college education, and they are funded by governmental largesse. Tier 1 schools teach a wide range of students, perform a great deal of research and rely on private philanthropic support, as well as tuition and federal grants. Tier 2 and Tier 3 schools lie between these extremes. Tier 3 schools are more focused on pedagogy and residential services. Tier 2 schools do more research. The largest gap between public and private schools is that public schools have many more students, which is associated with lower revenues per student and far less residential housing.

The first panel in Table 1 illustrates both the size and focus on these schools. Tier 1 and Tier 2 schools are much larger, with approximately 30,000 and 20,000 students per school respectively. Tier 3 and 4 schools average around 3,000 students per school. The share of graduate students declines monotonically from 31 percent in Tier 1 schools to 22 percent in Tier 2 schools to 17 percent in Tier 3 schools to essentially zero in Tier 4 schools. The average public school has nearly five times as many undergraduates as the average private school.

Traditional liberal arts majors of physical and life sciences and social sciences are highest in tier 1 schools and decline as one moves across tiers. Pre-professional education, such as business, education and health, are more abundant in the other tiers, making up 48 percent of majors in Tier 3 schools. Tier 4 schools specialize both in the arts and humanities, because studying liberal arts in a two-year school is a typical pathway to entering into a four year school, and health, which is a more purely pre-professional field.

[16] Notably, Rockefeller University is considered tier 3 because they have fewer PhD students than the criteria for R1 universities. This affects some of the averages around research, as we note below.

While private universities are three times as expensive as public universities: roughly $27,000 to $9,000, there is no difference between public and private schools across tiers 1 to 3 in average educational spending per student.[17] costs per student differ sharply across tiers. Tier 1 schools report over $33,000 per pupil in instructional expenditure, although it can be difficult to appropriately distinguish between teaching and research-related faculty costs.[18] Tier 2 schools spend $25,000 per student. Tier 3 and tier 4 schools report totally different costs at $11,000 and $6,000 respectively.

Tier 3 schools specialize in the bundling of teaching and living space, as do private schools more generally. While Tiers 1, 2 and 4 have from .26 to .32 beds per student, Tier 3 schools can typically house 54 percent of their students. Public schools can house 30 percent of their students and private schools have space for 62 percent of their students. Figure 6 illustrates how some schools specialize in high-touch college experiences. In the quarter of schools with the lowest spending on resident services, the average student-faculty ratio is 19. In the schools with the highest ratio, which are typically liberal arts colleges, the student-teacher ratio is slightly higher than ten.[19] No very large schools house all of their students.

Research Heterogeneity across Universities

The next panel focuses on research, which is a core activity for tier 1 and tier 2 schools, but is largely absent from tier 3 and tier 4 schools. On average, tier 1 schools spent $170,000 per

[17] Actual tuition revenue differences are more muted, however, partly because reported tuition reflects a combination of undergraduate and graduate students, many of whom pay little in tuition.

[18] Formally, instructional expenditure includes expenses for all activities that are part of an institution's instruction program; general academic instruction, occupational and vocational instruction, community education, preparatory and adult basic education; credits and non-credits courses; academic instruction, tutorial instruction, and regular, special, and extension sessions; faculty salaries and benefits for teaching; and departmental research and public service that are not separately budgeted.

[19] A regression of residential share on the student-faculty level at the school level has a coefficient of -37, with a standard error of 5.

faculty, and the median tier 1 school spent $130,000 on research. The skewness in tier 2 research spending is far more extreme: average research spending per faculty member is $144,000, almost as much as in tier 1 schools, but median spending schools is only $62,000. This gap reflects the enormous amount of spending per faculty member in a few schools. In tiers 1 and 2, the median school spends nothing on research. Interestingly, the median private school also spends nothing on research, and the median public school spends only $3,500 per faculty member.

Research spending is extraordinarily concentrated. Figure 7 shows that about 50 percent of all research spending has been concentrated in just ten universities for almost all over the years between 1997 and 2024. Three-fourths of research spending is associated with just 25 schools, and 90 percent of spending occurs in fifty schools. Research output mirrors the spending trends across tiers. Citations, Nobel Laureates, and patents all follow the trends of research dollars. In research, there appears to be significant scale economies.[20]

These research intensive schools educate a relatively small number of undergraduates. Figure 8 shows that the top 25 schools by research, which are responsible for 75 percent of research spending, educate fewer than five percent of undergraduates. The 100 schools that are responsible for virtually all of America's academic research spending teach approximately one tenth of all undergraduates.

Finances across Universities

The final block of the table shows data on university finances. Tier 1 universities have average revenues of $3.5 billion per year, which would not put them in the Fortune 500.[21]

[20] The faculty-led model of hiring and tenure in most research universities will also tend to ensure that research-intensive faculty are only willing to hire other research-intensive faculty.

[21] Eli Lilly is ranked 100 on the Fortune 500 list of companies by revenues, and its annual revenues are $45 billion. Vulcan Materials is ranked 500 and has $7.4 billion in annual revenues.

Revenues are much smaller in the other three categories. Both tier 1 and tier 3 schools have median revenues of more than $100,000 per student. Tier 2 schools, many of which are public, have substantially lower revenues per student. Private schools in tiers 1-3 have an average revenue per student of $63,000, while public schools in the same tiers average $53,000 in revenue per student. Tier 4 schools average $33,000 of revenue per student.

Tier 4 schools also receive a remarkably small share (7.4 percent) of their revenues from tuition. In the other tiers, the share of revenues from tuition ranges from 23 percent (tier 1) to 33 percent (tier 3). Private schools receive on average 50 percent of their revenues from tuition, while public schools receive only 25 percent of their revenues from their tuition. Over 50 percent of the revenues for public universities come from some public source, most of which is state and local appropriations. By contrast, only five percent of private school funding comes from the government, and that comes almost entirely from the federal government. Sixty-four percent of tier 4 school's funding comes from a public source.

Private philanthropy follows a reverse pattern to public funding. Thirty-five percent of private school revenues come either from investment income, which generally reflects past philanthropy, or current gifts. Only 8 percent of public school revenue comes from these two sources. Tier 4 schools receive four percent of their revenues from philanthropy, compared to 31 percent of tier 1 schools. Tiers 2 and 3 both have philanthropic shares of earnings around 18 percent.

Tier 4 schools spend 15 percent of their budgets on student services, which includes career services and counselling. Perhaps more surprisingly, tier 4 schools spent 27 percent of their budgets on "institutional support," which includes administration and non-educational budgetary items. Readers who work at tier 1-3 institutions may be surprised to know that their

institutions are remarkably lean administratively, with budgets shares of 11 percent in institutional support. But the institutional support shares are much higher in private schools (25 percent) than in public schools (13 percent). The research spending share differs dramatically across tiers. Tier 1 schools devote 24 percent of their budgets to research, almost as much as they spend on instruction.

Across all six categories, athletics is responsible for 4 to 5 percent of revenues. The athletic share of spending is also relatively constant across tiers, generally 5-7 percent. The fact that the cost shares are considerably higher than the revenue shares reflects the fact that most schools lose money on athletics. It is possible that there are non-revenue benefits from athletics that offset those added costs.

IV. The Origins of the Multi-Product Non-Profit

In this section, we sketch the origins of western universities.[22] We start by showing how small agglomerations of teachers in particular locales established guild-like institutions. Over time, this grew to include certification, then housing and finally sponsored research. We also examples of the fractious behavior that occurred in early universities and how it changed the world of universities.

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The Guild of Independent Teachers

[22] We have opted to keep a western focus, because of the limits of our knowledge and because we are specifically interested in U.S. universities and their direct antecedents. We do not discuss Cathedral schools and teaching monasteries in the U.S., largely because they have a far more centralized organization form than a university. The Monastery of Nalanda was a great center of Buddhist learning as early as the fifth century CE, which is described by the travelogues of both Yijing and Xuanzhang, but it seems closer to a western teaching monastery, as Bec during the time of Anselm of Canterbury, than a university. Islamic schools, such as the 11th century Nizamaya Madrasa in Baghdad, seem much closer to the western model and may have helped to inspire that model (Makdisi, 2019). Islamic schools also share the feature of an independent entity, typically a Waqf, that protects their capital from faculty expropriation.

If Pierre Abelard (1079-1142) had been conventionally religious, he presumably would have become a monk at an academically oriented Abbey,[23] but Abelard's memoirs (the Historia Calamitatum) reports that he "found the armory of logical reasoning more to my liking than the other forms of philosophy."[24] Instead, he studied by "journeying through many provinces, and debating as I went, going whithersoever I heard that the study of my chosen art most flourished, I became such an one as the Peripatetics." High medieval travel costs explain why teachers co-located near one another, in order to attract students who didn't to imitate the wanderings of Abelard.

In 1136, John of Salisbury "betook myself to the Peripatetic of Pallet [Abelard], who was then teaching at Mont Ste. Genevieve," the future home of the Pantheon. While Paris' Cathedral School provided an "exogenous" source of demand that attracted teaching talent, at this point Abelard was a free agent.[25] John relates that after Abelard's "departure which seemed to me all too soon, I became the disciple of Master Alberic" who "was always most meticulous, and everywhere found something to question." Still on Mt. Ste. Genevieve, John also studied with Robert of Melun, and "while Albericht was full of subtle questions, Robert was penetrating, concise, and to-the-point in his replies." By 1140, a community of independent teachers, "who had keen minds and were diligent scholars," had emerged on the Left Bank of the Seine resembling earlier clusters of teachers of law in Bologna and Medicine in Salerno.[26]

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[23] For example, St. Anselm appears to have made the Abbey of Bec into a place of theological learning a generation before Abelard. Later abbeys, such as St. Thomas' Abbey in Brno, would also be places of scientific learning, such as Gregor Mendel's genetic experiments.

[24] As Rashdall (1895) relates "All the enlightened ecclesiastics of the time were educated in Monasteries, and most of them were Monks," but it was, as we shall see, from the Cathedral Schools that the Universities were at length developed when the intellectual enthusiasm of the Middle Age began to flow in a distinct channel from its religious enthusiasm.

[25] When Phillip August erected his walls around Paris at the end of the 12th century, Mont St. Genevieve would just lie inside.

[26] The cluster in Bologna appears to have emerged around Irnerius (c. 1050-1125) and his students, whose legal knowledge benefited greatly from the rediscovery of Justinian's law code around 1170 (Mousourakis, 2015). Constantine the African may have played a comparable role in the growth of the medical school in Salerno, which

When did clusters of independent scholars first coalesce into the "university"? Ward and Waller (1920) write that "the earliest trace of this university has been discovered in the passage where Matthew Paris states that his own preceptor, an abbot of St. Albans, had, as a student in Paris, been admitted into "the fellowship of the elect Masters" (*c.* 1170).[27] The great 19th century historian of medieval universities, Hastings Rashdall (1895), tells us that "the university was originally a scholastic Guild whether of Masters or Students," and that "such Guilds sprang into existence, like other Guilds, without any express authorisation of King, Pope, Prince, or Prelate."[28] Like all such guilds, they existed to bargain, restrict entry, police their own members and protect them from outsiders, and to lobby for benefits from political superiors.[29] These guilds differ sharply both from teaching monasteries, like that of Anselm of Bec, because Abbots typically enjoy great authority over their monks and from modern universities, because pre-modern teachers typically negotiated fees directly with their students.[30]

While many scholars may have aspired to restrict competition, informal scholarly agglomerations only become universities when they receive some form of official recognition. The University of Bologna received that recognition in 1155 (the *Authentica Habita*) from the Holy Roman Emperor Frederick I. The Emperor was attempting to secure legal control over the communes of northern Italy, and Bologna's best legal minds were able to repay the Emperor for

benefited from the Sicilian fusion of classical texts, such as Galen and Hippocrates, with knowledge coming from Arab and Jewish sources.

[27] The original Latin ("ad electorum consortium Magistrorum meruit attingere") can also be translated as "merited to be attached to the elite group of teachers."

[28]Rashdall (1895) also reminds us that university does not mean "a School in which all the Faculties or branches of knowledge are represented," but rather just "the whole of you," meaning all of the teachers or all of the students in one place. Paris provides the model for the faculty-based university, while Bologna originates the student-based university.

[29] In Bologna, the student "Universities" tried to use their monopsony buying power to control the faculty and "the Doctors were compelled, under pain of a ban which would have deprived them of pupils and income, to swear obedience to the Students' Rector, and to obey any other regulations which the Universities might think fit to impose upon them" (Rashdall, 1895).

[30] Rashdall (1895) states that fixed academic salaries began because "neighboring towns, in their eagerness to rival the Academical fame of Bologna would make overtures to a Bologna Doctor" and contract for "the payment of certain *stipendia*."

their charter by defending his rights at the Diet of Roncaglia in 1158.[31] King Philip II (Augustus) of France granted the community of Parisian scholars its 1200 "charter," to protect its scholars from local authorities, including the Provost of Paris himself.[32] Similarly, Honorius III called for the academic freedom (*libertas scolastica*) of the University of Bologna in 1220 in their fights with town leaders (Hoye, 1997).[33] Academic freedom then begins as a tool for ensuring that an institution that a distant authority found useful remained independent of local power brokers.

Expansion to Certification

Like any guild, university faculties had a formal means of recognizing the right of a member to ply his trade, and the diploma "was in its origin nothing more than a qualification to teach," which emerged as "trades-unions ultimately triumphed over liberty of contract, and the right of teaching became practically, if not theoretically, restricted" (Rashdall, 1895, p.204).[34] By the early 13th century, the University of Bologna was issuing official licenses to teach, although exactly how the faculty and the Archdeacon of Bologna shared control over granting those licenses is difficult to discern.[35] This local license then evolved into a more general teaching license, both informally, as schools chose to accept each other's credentials, and formally through edicts such as the 1292 Papal Bull that "conferred on all Doctors licensed by the

[31] The four doctors of Bologna who supported Frederick Barbarossa at Roncaglia may have all studied with Irnerius.
[32] The document seems to have been a response to the death of five scholars in a riot with townspeople.
[33] Gregory XI would support the academic freedom of the University of Paris in 1231 for similar reasons (Hoye, 1997). In 1222, some of Bologna's scholars fled Padua which illustrates how professorial mobility can also protect academic freedom.
[34] Makdisi (1970) writes that while in Europe the "license to teach" was "was conferred by the licensed masters acting as a corporation, with the consent of a Church authority," as we have discussed, "certification in the Muslim East remained a personal matter between the master and the student," He emphasizes that the certification was the right to teach a book (or books) and that "the master authorizing the book was either its author or a person duly authorized to teach it."
[35] Rolandino of Padua describes how he received in 1221 the office of the magistrate ("recepi officium Magistratus") from his teacher, Boncampagno, in Bologna, but two years earlier Pope Honorius III issued a decretal giving that power to the Archdeacon. The Pope seems to have been trying to reduce the teaching of classical Roman law, which was not under his control, in favor of canon law, which the Vatican could shape.

Archdeacon of Bologna the right to teach not only in Bologna but throughout the whole world" (Rashdall, 1895, p. 224).[36]

The next step in the evolution of the diploma was that it served as a signal of learning "by persons who had no intention of devoting themselves, or at least of permanently devoting themselves, to the work of teaching" (Rashdall, 1895). In the course of the 12th century, as "the services of learned men came to be in general request, it was natural that this certificate of competency should be valued for other than teaching purposes," and "the style of Master came to be regarded as a title of honour which it was not beneath the dignity of a Bishop or a Cardinal to prefix to his name" (Rashdall, 1895, p. 5). Political leaders also relied on universities to screen for competence. In 1231, Emperor Frederick II declared that "no one may dare otherwise to practice or to heal, pretending the title of physician, unless he has first been approved in a convened public examination by the Masters of Salerno."

Universities profited from the demand for certification by extracting graduation fees or services, including feasts and bullfights, that were distinct from tuition fees paid to teachers.[37] These extra graduation fees provide evidence of the value of a "medieval sheepskin."[38] By branching into certification, universities were expanding their product range. Teaching and certification are complements in production, because the same scholars who taught were well-qualified to judge knowledge. While there have certainly been limits on faculty control over the granting of degrees, faculty largely continue to control the certification process today, though

[36] Rashdall (1895, pp. 12-13) notes that even when the right to teach everywhere may not have been respected, even when that right was "most indisputably assured by Papal or Imperial authority." He suspects that "the great primeval Universities perhaps never recognised the Doctorates conferred by always the younger bodies." The term *studium generale* was used to denote an educational entity that had the right to confer a license to teach in other schools.

[37] In 1311, the Council of Vienne capped graduation fees at 3000 Tournois pounds (Rashdall, 1895, p. 232). The fact that students were willing to pay significant graduation expenses indicates the signaling value of the diploma, over and above the knowledge learned.

[38] Hungerford and Solon (1987) and Jaeger and Page (1996) provide evidence on the value of the sheepskin in modern labor markets.

subject to more-or-less strict accreditation standards, which may explain why few universities have competed by reducing the number of years needed to earn a degree.

Campus Heretics

Yet even in this primordial state, the proto-university became a place of conflict, as scholars fought with each other and other scholars and with external (typically ecclesiastical) authorities. Abelard himself seems to have had an enormous taste for intellectual conflict, especially with his own teachers. Abelard wrote that Anselm of Laon "began to persecute me for my lecturing on the Scriptures no less bitterly than my former master, William [of Champeaux], had done for my work in philosophy." Two of Anselm's students brought heresy charges against Abelard in 1121 which led to an official condemnation of his teaching. Subsequent conflict between Abelard and Bernard of Clairvaux led to Pope Innocent's II excommunication of Abelard. While this excommunication was eventually lifted, Abelard's conflict with religious authorities was almost unavoidable. Great scholars challenge the intellectual status quo, and that inevitably produces conflict.

Such disputatiousness would reappear over and over again in academics over the next 900 years. In 1256, William of Saint-Amour, another Parisian Professor, wrote *De Periculis Novissimorum Temporum*, a searing attack on the mendicant orders, such as the Dominicans. In the same year, St. Thomas Aquinas, a Dominican, struck back with his *Liber Contra Impugnantes*. The mendicants and the Parisian professors competed for students, which makes this conflict unsurprising, and in line with academic disputes throughout the ages. More unusually, William didn't have the standard academic privilege of resting securely in his tenured chair, because Pope Alexander IV was a strong supporter of the mendicants. The pope both

excommunicated the professor and exiled him from Paris. While Pope Honorius III may have lauded the academic freedom of the University of Padua, the true intellectual freedom of theological scholars was determined by the heresy courts.[39]

While few theological battles have achieved the same fame as the heresy trial of Galileo (Professor at the University of Padua), far more academic battles involved theology than science.[40] Academic intellectuals played an outsized role in the Protestant Reformation. John Wycliffe (1328-1384), the Master of Balliol College, Oxford, condemned property ownership by the Church, embraced predestination, engineered the writing of an English bible, and encouraged a clandestine, separatist sect, the Lollards. All of these actions foreshadowed the Protestant Reformation that sundered Catholic Christendom. Only the distance between Rome and Oxford allowed Wycliffe to die from a stroke, rather than at the stake. The 1415 Council of Constance demanded the burning of his body, and his body would also be removed from the grave and consigned to the fires.

That council also led to the burning of Jan Hus, a Professor at the University of Prague, who was a follower of Wycliffe and critic of the sale of Papal indulgences. His execution set off the Hussite wars, in which Hussite armies fought off four separate crusades, and established a separate Hussite Church within the Catholic Community.[41] Eventually, a truce led to the establishment of a Hussite Church within the Catholic Community, where foreshadowed the later schism of the Reformation.

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[39] Some ecclesiastical authorities were even more prescriptive. The 1215 statutes for the University of Paris written by Papal Legate Robert de Courcon decreed that "non legantur libri Aristotelis de methafisica et de naturali philosophia, nec summe de eisdem," which forbids the reading of Aristotle's works, or their summaries, on metaphysics and natural philosophy.

[40] The fame of Galileo's trial owes much to the fact it depicts the fight for academic freedom as a battle for truth against censorship. While we are comfortable that Galileo stood for truth and his enemies did not, we have no confidence that the theology of Wycliffe or Hus was any more or less correct than that of their intellectual opponents.

[41] Hus had been promised a safe-conduct to the conference, which made him a particularly compelling martyr to his followers.

Martin Luther and Philip Melancthon both taught at the University of Witternberg. Jean Calvin appears to have experienced his religious "conversion" while studying theology, Greek and Hebrew at the University of Paris. Emmanuel College, Cambridge, was a "nursery of Puritans" and a model for Harvard College. The 1662 Act of Conformity aimed to eject Puritans both from the churches and from the universities and to break "a strong and distinguished tradition which had made Cambridge, in particular, a Puritan Citadel" (Cragg, 1957). As late as 1723, the distinguished philosopher Christian Wolff was ejected from the University of Halle and Prussia itself because of intellectual disagreements with his Halle's prevalent Pietistic theology (Hoye, 1997).[42]

As the world and universities secularized, there were fewer academic battlers over heresy, but political leaders still found themselves at odds with academics. Metternich famously promulgated the Carlsbad decrees in 1819, which attempted to root out nationalistic and liberal agitation in German universities. A strand of McCarthyism took aim at "Red-ucators" in academia, including those allegedly at Harvard University. Academic freedom largely survived political attacks in countries like the US and UK with strong traditions of freedom of speech. In other settings, however, such as Nazi Germany or Communist Russia, state control over the academy became near absolute.

Academics, such as Abelard's early accusers, have often participated in the repression of new ideas. The theologians of the University of Paris were the primary censors of religion and science-related printing in France printing (Darnton, 2014). Henry Sacheverell, fellow of Magdelen College, Oxford, university bursar and senior dean of arts, preached "The Perils of False Brethren" in 1709, which aimed at all enemies of high church Anglicanism, such as those

[42] Hoye (1997) also notes that at the same time, Harvard was drawing a distinction between academic freedom in philosophical matters, which was protected, and academic freedom in theology, which was not.

"Bodies, and Seminaries, wherein Atheism, Deism, Tritheism, Socinianism, with all the Hellish Principals of Fanaticism, Regicide, and Anarchy, are openly Profess'd and Taught, to Corrupt and Debauch the Youth of the Nation in all Parts of it, down to Posterity, to the Present Reproach, and Future Extirpation of Our Laws, and Religion." Thousands of copies of this sermon spread throughout England, and riots broke out, supporting Sacheverell and targeting religious minorities. Innovative academics can teach hatred as well as heliocentrism.

V. Universities as Hoteliers and Athletic Franchises

In contrast to teaching and certification, there is no obvious overlap in the skills needed to teach philosophy and the talent involved in running a hotel or a multi-sport athletics operation. Yet all of America's largest universities also engage in the hotel business, and athletics is important as well.

The Rise of the Residential College

In medieval France and England, residence-providing entities, which we will refer to as residential colleges, emerged as separate legal entities accompanying universities. In the U.S., wealthier universities such as Harvard, Yale, and Columbia operate their own, often quite large, residential operations. The residential operations of America's schools reflect the tendency of American schools to follow the British model and locate away from major population centers, the generosity of American philanthropy, and the belief that the co-location of students generates intellectual spillovers.

Residential colleges began as charitable spaces to house and feed disadvantaged students. They were "comparatively unimportant in Bologna and the other Italian Universities" where

"they remained to the last (what all Colleges were originally intended to be) eleemosynary institutions for the help of poor students, boarding-houses and not places of education" (Baxandhall, 1895, p. 199). The first European college intended to house a wider range of scholars appears to have been the Sorbonne, which was founded by Robert of Sorbon around 1250. In 1257, the King himself gave Sorbon a house near the thermal baths of Cluny "for the work of the scholars who will stay there," and more real estate would follow.[43] In 1258, the will of the wealthy doctor and cleric left "1500 Parisien pounds and all his books to support the theological studies of the future scholars of Sorbon's house and other poor scholars."[44] These bequests came slightly later than the 1249 bequest of William of Durham of 400 marks to buy land near Oxford to house six scholars who were born near his home town. Durham's gift is typically interpreted as the founding gift for University College, Oxford.

In both Paris and Oxford, the residential colleges were legally distinct from the universities, but donor control was much tighter in Paris. In Oxford, the Colleges were and are typically led by Oxford faculty, but at the Sorbonne "the supreme government of the foundation and the filling up of its' burses was entrusted to a body of external Governors" and consequently "in many cases, the property of the Paris College was far less the common property of the Head and Fellows than was the case at Oxford and Cambridge" (Baxandhall, 1895). The different governance structures reflect the fact that while the Oxford gifts were typically the ordinary charity of generous churchmen, the Sorbonne was tied to the religious agenda of a Saint-King and his clerical allies. Indeed, the Sorbonne would support French Kings in their battles both with the Papacy and the enemies of absolutism for the next five centuries.

[43] The quotation is our translation of "ad opus scolarium, qui inibi moraturi sunl" (Denifle, 1889, p. 349).
[44] The full quotation is our translation of Denifle's (1889, p 372) summary of Robert of Douai's will ("Testamentum magistri Roberti de Duaco, legantis 1500 libras paris. omnesque suos libros ad opus scholarium in theologia studentium futurae domus Sorbonae et aliorum pauperum scholarium").

The 13th century colleges brought a new educational model to western universities, and a new rationale for housing.[45] The Sorbonne's motto "vivere, socialiter et collegiality et moraliter et scholariter" (to live socially and collegially and morally and scholarly) captures the spirit of learning through physical proximity, which is now documented in a significant literature that now documents peer effects on campus.[46]

Real Estate and Higher Education in the United States

Early American colleges offered living space, both because they emulated British schools – often located far from existing population centers that could provide housing – and because there was a belief in the intellectual value of residence-based education. The 1828 "Reports on the Course of Instruction in Yale College" noted that in non-urban campuses "students should be so collected together as to constitute one family; that the intercourse between them and their instructers [sic] may be frequent and familiar," and consequently "this renders it necessary that suitable buildings be provided, for the residence of the students." But these early steps would be dwarfed by the massive construction of university residential buildings (and academic structures more generally) during the late 19th and early 20th centuries, as the large fortunes earned during the gilded age were transformed into collegiate brick, granite, and sandstone. Goldin and Katz (1999) emphasize

In 1884, railroad magnate Leland Stanford and his wife Jane visited Harvard's President Charles Eliot. Leland supposedly asked Eliot, "How much would it cost to duplicate all this?" According to Nicholas Butler (1939, p. 149), longtime President of Columbia, Eliot demurred, noted that he believed that "the larger value of Harvard University was to be found not in its

[45] The residential scholarship model already existed in the more academic monasteries and Madrasas. The direct ancestor of the residential colleges was the housing provided in Paris for particularly poor clerics and scholars.
[46] The college peer effects literature includes Sacerdote (2001) and Barwick (forthcoming).

grounds, its buildings, and its material equipment, but in its traditions, its history, its achievements, its influence." When Stanford responded, "Oh yes, I know … but how much money would it take to duplicate this campus and all these buildings?" Eliot said as much as $15 million (over $500 million today).[47] Thereupon, Jane "gleefully" proclaimed "we can do it Leland."[48]

This story makes three points. First, by the mid-1880s, older colleges and universities had already accumulated considerable physical assets. Second, a new class of extremely wealthy donors, such as Stanford, were interested in investing in such assets either in existing or new colleges. Third, Eliot's diffident initial response indicates the difficulty that older faculty members (but not Eliot himself) would have in coming to terms with grand new campuses controlled by corporate titans.

Figure 9 shows the growth in the real estate portfolio of Harvard University as a whole, and its Faculty of Arts and Sciences over the past 400 years. While Harvard's physical footprint was modest in the mid-19th century, it exploded between 1880 and 1930. This expansion occurred first in the college and then in the professional schools and the athletic stadium. This growth was accomplished with donations, many of which were given by individuals who would serve on the Harvard Corporation.

Still, the gifts of these 19th century donors were dwarfed by the largesse of the 1890s mega-donors: the Stanfords ($20 million to Stanford, roughly $800 million today) and John D. Rockefeller ($35 million to the University of Chicago, roughly $1.25 billion today). Stanford always embraced a residential vision, possibly because the school was isolated in the middle of

[47] Today, Harvard has buildings valued at over $7 billion (Harvard University, 2025, p. 32).
[48] In another version of the story, Eliot told the Stanfords that establishing a university would take an endowment no less than $5 million. Leland Stanford is reported to have said "Well, Jane, we could manage that, couldn't we?" Stanford's initial endowment turned out to be about $20 million.

the Stanfords' 8,000 acre farm. Stanford wanted housing "along the lines of a large, modern hotel," and the first dormitory, Encina Hall, was modeled on Switzerland's Maloja Palace. Governance issues were sidestepped because "the Stanford Estate Business Office – not the University president – was in charge of Encina."[49] By contrast, the academic aspirations of the University of Chicago were "to establish, not a college, but a university" (Talbot, 1936), and residences got short shrift. In February 1892, as student interest burgeoned, the school quickly leased local apartment buildings.

Columbia University, founded in the mid-18th century, faced almost the same challenges as Chicago in the 1890s when it relocated from midtown New York to Morningside Heights. A generous donation by Columbia President (and New York Mayor) Seth Low paid for the iconic Low Library, which also housed the president's office, but the school didn't start building residential buildings in Morningside Heights until 1904. Columbia paid for one of the new Morningside residential buildings by selling some of the mid-Manhattan property that made up its endowment.[50] The other structure was funded by a gift from a recent graduate and arms heir.

The culmination of residential college building in the United States before World War II was the construction of residential house systems in the 1930s by Harvard and Yale. In 1904, Harvard Professor and future President Abbot Lawrence Lowell wrote an article on "dormitories and college life," for the *Harvard Graduate's Magazine*. Lowell emphasized intra-student intellectual spillovers ('the real training of students comes from one another as well as from the instructors") and that consequently "a college education without a community life cannot permanently succeed." He argued that community-building "can never be done by outside

[49]https://www.yumpu.com/en/document/read/9650089/w-encina-hall-leland-stanfords-grand-hotel-w-stanford-historical-

[50] Columbia had the largest endowment in the country from 1875 to 1915 (Kimball and Johnson, 2012), but it was in the relatively illiquid form of mid-Manhattan real estate (the "Upper Estate"). The school gained more financial freedom by leasing that land to form Rockefeller Center in 1928.

dormitories built by private enterprise, because their effect is of necessity a segregation into distinct social groups based largely on wealth," but that "it can be done only by means of modern college dormitories, large enough to house the great bulk of the students within the College walls."

Twenty-four years later, Standard Oil heir Edward Harkness walked in the office of now Harvard President Abbot Lawrence Lowell "offered him three million dollars to build and endow an 'Honor College' with resident tutors and a master, the members to be picked from the three upper classes" (Morison, 1936). Morison (1936) continues: "[I]t took Mr. Lowell about ten seconds to accept," and "[T]he Governing Boards took up the plan with such alacrity and enthusiasm that Mr. Harkness in a few weeks increased his offer to ten millions for equipping no less than seven houses to be built from the ground up, and the others to be created out of existing halls, with suitable additions and alterations." Harkness would follow up this munificence with an even larger gift to Yale, his alma mater. For Harkness, the goal appears to have been to replicate the college experience at British universities such as Oxford and Cambridge.

The residential college system substantially changed the educational experience of both Harvard and Yale, illustrating how donor initiative can substantially reshape universities. The university's porous institutional design allows external entrepreneurs to shape the organization, as long as the entrepreneurs are willing to contribute. There is a role for outside investors to influence activity in a corporation by, for example purchasing a majority of the company's shares, but that is quite different than offering a bit of money for the company to enter into a new business line, which is far less rare in the university sector than in the corporate sector.

While certification and teaching are natural complements, managing residential space and teaching are not. The primary complementarity between residential living and teaching lies in the

production of knowledge by the students themselves. Nonetheless, many 19th century teachers were also ministers who may have enjoyed the ability to mold the characters of young college students. Consequently, "extracurricular life was also closely regulated, and an enormous amount of energy seems to have gone into keeping unruly students from misbehaving" (Jencks and Reisman, 1968). In response to the student protests of the Vietnam Era, universities typically loosened those rules.[51] Jencks and Reisman (1968) argue that the specialization of faculty members in scholarship made them increasingly unwilling to act as enforcers of behavioral rules on errant teenagers. By the late 20th century, any complementarity in production between teaching and managing living spaces had essentially disappeared.

College Athletics

While donors often initiated the development of residential colleges, undergraduates themselves drove the growth of college sports in the 19th century.[52] The sports of cricket, rowing and rugby emerged in English schools and colleges, and they seem to have migrated across the ocean in the mid-19th century. While rowing was relatively gentle, rugby evolved into an extremely violent form of football.

Harvard President Charles W. Eliot was an enthusiastic oarsman, but he was quite hostile to football.[53] Nonetheless, Harvard had opened the nation's largest stadium in 1903, by which time it had won three national championships. The growth of Harvard's football program

[51] We are not going to chronicle the ebb and flow of student-faculty conflict. Rashdall (1895) describes how in Medieval Bologna "the University of students once formed was stronger than the handful of Professors." The students were, after all, the customers. By contrast, in 19th century New Haven, parents who paid the bill in New Haven typically cared about the "moral education" of their children, which spurred colleges to enforce activities like chapel attendance. Faculty-student or trustee-student conflict from the Vietnam War onward, often focuses on using university resources to achieve a political goal desired by the students.

[52] It is possible that "Athletics at Harvard began in 1780 when the sophomores challenged the freshmen to a wrestling tournament with the losers buying dinner" (Powers, 2016).

[53] In 1905, he wrote: "the game of football has become seriously injurious to rational academic life in American schools and colleges,"

reflected the enthusiasm of players, coaches, and wealthy alumni for the sport. The stadium was built with the $100,000 25th reunion gift of the class of 1879. Lucius Littauer, Harvard's first football coach, had graduated in 1878, but he coached for free, as did all the early football coaches. Only in 1901 did the Harvard Athletics Association, which was alumni-funded and independent of the university, start to pay a coach, Henry Lewis.[54]

The robust interest in college football during the 1920s led to a wave of investment in massive football stadiums. Eleven out of the twelve largest stadiums in the US were built for college football teams between 1921 and 1930. Almost all of these were for large state schools. As most of these schools had limited residential space during this era, football may have served as a substitute for living on campus in generating school spirit. To this day, most of these schools attract huge audiences to their games and generate significant revenues from sports – though not enough to cover the full athletic budget, as noted above.

Professors rarely have much to contribute to the playing or coaching of athletic teams, and as Eliot's quotation suggests, there seems little complementarity between sports and learning for the students. The complementarity comes from campus life, because students enjoy both participating in and going to sports games. Moreover, until very recently, colleges had access to unpaid athletes and a natural attendance base, among current students, alumni, and for state schools, many local residents with no direct affiliation with the school. Successful athletics can spur alumni donations; men donate 7 percent more to their former college when their school wins a conference championship (Meer and Rosen, 2009).

Getting Tenure: Conflict between Faculty and Administrators

[54] Lewis' pushed for reforms to make the sport safer, and he would be appointed by Harvard alum and then-President Theodore Roosevelt, as an Assistant U.S. Attorney for New England in 1907.

In 1913, James McKeen Cattell, a pioneering psychologist, published a 484 page book on "University Control," as the third volume in a series (which he edited) on "Science and Education," and published by the Science Press (which he owned and which published the journal "Science"). Cattell claimed that the medieval "university, in an age of feudalism and of absolutism of state and church, attained a remarkable freedom, and its great performance was in large measure due to this freedom," whereas in his own day "the university president and school superintendent, have assumed powers and perquisites utterly subversive of a true democracy." Cattell is clearly arguing over the allocation of resources generated by Gilden Age philanthropy when he writes "It is subversive of decent social and educational ideals for the president of Harvard University to be permitted to build on the grounds of the university a house for himself costing $100,000, and for the trustees of Columbia University to build for their president a house which with its grounds may cost twice that amount," while "it would be in the interest of the university and of society if the salaries of professors were increased."

The heart of the book was Cattell's proposal for a new and far more faculty-controlled university, which he had first published in *Science* in 1911, and a characterization of the 299 largely positive faculty responses to his proposal from all over the U.S. For example, Cattell proposed "The professors or officers, or their representatives, should elect a president who has expert knowledge of education and of university administration," whose "salary should not be larger, his position more dignified or his powers greater than those of the professor." Cattell described the faculty responses he received to his proposal as "Referendum of Administration," despite the fact that they were not random. He found that 188 out of 299 responses favored the

faculty democracy that he proposed, 68 just wanted more faculty control, and only 46 were happy with the "limited autocracy" of the "present system," as Cattell labeled it.[55]

Cattell's book illustrates the conflicts that naturally followed the vast increase in university resources during the late 19th and early 20th centuries. Those resources empowered Presidents, such as Columbia's Nicholas Murray Butler, which clearly galled faculty like Cattell, who had been used to more faculty dominance in the poorer institutions of the 19th century. While faculty had elected Nicholas Murray Butler Dean of the Faculty of Philosophy in 1890, as President "Butler ended the election of deans by their faculties and then created the position of assistant dean for each college, with each assistant dean serving on the university council, thereby diluting the power of the elected faculty on that body" (Gerber, 2014). Butler would also eventually fire Cattell, providing one of the *cause celebres* that help build support for the institution of tenure.

Cattell had largely created Columbia's psychology department, and his dismissal was surely a violation of an implicit contract, which Columbia tacitly acknowledged when the university gave Cattell over $12,000 in 1922 (over $230,000 in 2026 dollars). However, Sokal (2009) documents that Cattell was difficult with "a highly detailed narrative tracing both Cattell's increasingly unpleasant and damaging interactions with his Columbia colleagues and many aspects of the aftermath of his dismissal." Sokal (2009) argues that "it was the accumulation of these many instances of Cattell's continuing injurious behavior that actually led to his dismissal," rather than Cattell's opposition to U.S. entry into World War I. Cattell's behavior, including his ability to produce an almost 500 page documenting attacking the management practices of his

[55] Almost one-fifth of the pro-autocracy votes came from Harvard professors, who were far less excited as a group in faculty democracy than the scholars from Columbia, which suggests that the autocracy of Charles Eliot was seen (by the faculty at least) as far more benign that the autocracy of Nicholas Murray Butler.

boss, illustrates the autonomy enjoyed by many faculty members, even before the formal coming of the tenure system.

While faculty often enjoyed de facto tenure in the early 20th century, faculty dismissals were not unknown. Butler had fired literature professor Joel Spingarn in 1911. Stanford's dismissal of economist Edward A. Ross because of his political activity became a particularly powerful example of violating "academic freedom."[56]

Ross' dismissal led to an explosion. Faculty, such as George E. Howard and Arthur Lovejoy, left the university over the matter. In 1915, Lovejoy would cofound the American Association of University Professors (AAUP), which would allow faculty to present a united front in their fight for control against university administrators. The AAUP's founding in 1915 came with a "Declaration of Principles on Academic Freedom and Academic Tenure" which demanded that "the tenure of professorships and associate professorships, and of all positions above the grade of instructor after ten years of service, should be permanent." In 1918, in response to Cattell's firing, the AAUP issued a report that declared "it is a grave abuse of the power of dismissal to deny members of university faculties of their fundamental constitutional rights as citizens" (cited in Sokal, 2009).

In 1925, the AAUP participated in the conference that created the "*1925* Conference Statement on Academic Freedom and Tenure*."* The American Association of Colleges and Universities (AACU), which represented university administration, was part of the same conference and also endorsed the statement. The 1940 Statement of Principles on Academic

[56] Ross was fired at the urging of Jane Stanford. Ross promptly depicted himself as a victim of an outrageous attack on free academic inquiry and the discussion of research with "sober people, and in a scientific spirit." While perhaps some of Ross' speeches had that "sober" and "scientific spirit," Stanford seems to have been particularly offended at Ross' statements against Asian immigrants: "Should the worst come to the worst, it would be better for us to turn our guns upon every vessel bringing Japanese to our shores than permit them to land." Like many progressives of his era, Ross was passionate about free silver, monopolies, eugenics and race-based immigration restrictions.

Freedom and Tenure was also issued by the AAUP and the AACU and that became the basis for widespread adoption of a relatively standardized up-or-out tenure system. Tenure became standard at most institutions by 1970.

Just as significantly, faculty were acquiring power over personnel (Jencks and Riesman, 1968). Masten (2023) reports that in 1924 and 1941, fewer than 40 percent of schools in AAUP surveys report any faculty involvement in personnel decisions and this involvement typically meant only consultation. By 1970, faculty had "acquired effective authority," typically through a joint process that also involved administrators. By 2001, the majority of schools in the AAUP followed a shared governance system over faculty appointments.[57]

Why did administrators acquiesce in faculty tenure and an increasingly large role of faculty in the hiring and promotion process? Before the AAUP came into existence Charles Eliot wrote that the professorial "contract ought to provide for life-tenures after adequate periods of probation" because "life tenures in a permanent service are by far the most economical and effective." He argued that "the young American who chooses a university career must then abandon all expectation of riches, and of the sort of luxuries which only wealth can procure," and that in exchange what "he may reasonably expect is a secure income, a life-tenure, long vacations, the gratification of his intellectual tastes, good fellowship in study, teaching, and research, plenty of books, and a dignified though simple mode of life."

By providing the powerful amenity of lifetime employment (or at least employment until 65), universities were able to attract better scholars at lower wages than they possibly could have without that amenity. Moreover, as McLeod and Urquiola (2021) argue tenure provided "a salient reward for research performance," that enabled "top US schools came to enjoy a virtuous circle that gave them resources to invest in research, which they could effectively incentivize."

[57] This evolution mirrors the increase in the power of faculty that Gerber (2014) documents after 1920.

We remarked in Section II on the incentives created by tenure. Tenure is also an insurance scheme, and it may be a relatively efficient means for a large institution to insure its workers against unexpected shocks to their reputations and abilities.

The choice of administrators to share appointment power with faculty was more of a tacit recognition that scholarship had become more complex than a wholesale surrender to faculty power. At the start of his term, President Eliot was constantly looking for teaching talent, which meant that a profound scholarly track record was hardly necessary to get a job as an instructor at Harvard. In 1870, Eliot hired Henry Adams to teach medieval history, which he did quite successfully despite having produced no related scholarship before taking the position. President Conant would later write that "as the size and complexity of this Faculty increased, such a procedure [the President deciding all appointments] became unworkable and the standing committees of the Faculty known as Departments or Divisions came to play a predominant role in the making of appointments" (Conant, 1970). Only faculty had the expertise to select high quality research peers, and consequently their power over personnel increased.

VI. The Rise of the Research University

The final step in the growth of the modern university is the expansion of the expensive research mission. Research and teaching complement each other when the knowledge gained by research improves teaching, or if students can be directly embedded in the research process, as they are when they work in laboratories. This complementarity is larger when the demand for cutting edge knowledge is higher, and it will be lower when the overlap between the topic of scholarship and the topic of teaching is small. Published research has also served – since the time

of Abelard – as an advertisement of the teacher's knowledge, which can serve to attract fee-paying students.

Academic Research before Academic Laboratories

In the medieval era, students demanded learning in law, theology, and medicine, and faculty obliged.[58] Consequently, until the 18th century, university research mostly meant philological work on ancient texts.[59] Abelard and Irnerius were both scholars who acquired knowledge that improved their teaching. Even today, research in business and law overlaps closely with what many students want to learn, leading to a significant funding benefit.

But there were also early academic scientists. Mondino di Luzzi taught medicine at the University of Bologna in the early 14th century, and he restored the practice of learning anatomy through public dissection of cadavers. Two centuries later, teaching at Padua, Bologna's 1222 spinoff, Vesalius made dissections the basis of his pathbreaking anatomy books.[60] Herman Boarhaeve would continue this practical medical tradition at the University of Leiden in the 16th century.

Non-biological science came into universities through mathematics and astronomy, which provided skills needed for the astrology that could be an important part of Medieval medicine. Research in these fields began with the rediscovery of classic texts, such as Adelard of Bath's 12th century translation of Euclid into Latin from Arabic. Copernicus studied at both Bologna and Padua, its 1222 spinoff. Galileo was the professor of mathematics at Padua from 1592 to 1610.

[58] While biomedical research today looks quite different from studying early Christian writers, through the renaissance medical research involved studying Galen and Hippocrates (Siraisi, 2007).
[59] Of course, this did not mean that scientific topics were not covered. Scaliger's work on ancient chronologies hinged on astronomical events and he was a correspondent of Huygens. Medical scholars would sometimes relate ancient wisdom to events in their own careers.
[60] A science-friendly judge let him have the bodies of executed criminals.

While northern professions in 1600 did not require lengthy training in mathematics or science, there was popular interest in these topics. England's first chair in mathematics was endowed by Thomas Gresham,[61] who had founded London's Royal Exchange and pledged the rents from that institution to fund seven professorships, who would not train student but would rather give two public lectures (in Latin and English) each week. As Gresham also gave chairs in astronomy and "physik," this produced a cluster of scientifically minded individuals, who would later play an outsized role in the founding of the Royal Society. Robert Hooke was the Gresham Professor of Geometry, William Petty the Gresham Professor of Music, and Christopher Wren the Gresham Professor of Astronomy.

Perhaps because of Gresham's public lectures, interest in mathematics grew. More professorships followed, including the mid-17th century Lucasian Chair in Mathematics (after William Lucas, member of parliament for Cambridge), for which Isaac Newton would be the second occupant (Clark, 1904). The popular interest in science also meant that teachers at urban universities could fill public lecture halls by teaching about chemistry, and even performing public chemistry experiments.[62]

The Invention of the Teaching Laboratory

The path to teaching laboratories started with lecturers who performed experiments as part of their teaching, and with the private laboratories of individual scholars. In 1805, Benjamin Silliman observed a teaching laboratory in England and brought the idea of experiments back to Yale, where he taught generations of students.

[61] Gresham also gave us Gresham's Law – bad money drives out good.
[62] Joseph Black, in Glasgow and Edingurgh, and Pieter van Musschenbroek, in Leiden, provide two early examples of academic scientists who lectured to the wider public, and whose knowledge spillover over to the non-academic economy. Black helped Watt understand the science that underlay his separate condenser steam engine. Musschenbroek invented the Leiden jar.

The true teaching laboratory, combining training and cutting-edge science, is one of those rare innovations that seems to have both a clear author – Justus von Liebig – and a clear year of origin—1824.[63] Liebig provides a prime example of how extreme taste for knowledge that often drives selection into academia. Liebig had little interest in the classical curriculum of his high school. He later recounted how the school's rector "came to me and made a most cutting remonstrance with me for my want of diligence, how I was the plague of my teachers and the sorrow of my parents, and what did I think was to become of me, and when I answered him that I would be a chemist, the whole school and the good old man himself broke into an uncontrollable fit of laughter, for no one at the time had any idea that chemistry was a thing that could be studied."

At the age of seventeen, Liebig went to Paris, and he found the chemists who lectured at the Sorbonne to be an enormous improvement over German ones. Their lectures consisted of "experiments whose connection was completed by oral exposition." Liebig, whose father was a shopkeeper, recalled that "the experiments were a real delight to me, for they spoke to me in a language I understood, and they united with the lecture in giving definite connection to the mass of shapeless facts which lay mixed up in my head without order of arrangement."

Liebig was made a professor of chemistry at the university of Giessen in 1824 at the age of 21. He recognized "the need for an institution in which the students could be instructed in the art of chemistry, by which I mean familiarity with chemical analytical operations, and skill in the use of apparatus," and consequently "on the opening of my laboratory for teaching analytical chemistry and the methods of chemical research, students by degrees streamed to it from all sides." As Jackson (2008) documents, Liebig's students both learned and helped make

[63] Holmes (1989) notes that while Liebig had European predecessors in laboratory teaching, it was pioneering because "it became a highly productive research center, and it trained many chemists, some of whom became outstanding research chemists of the following generations."

discoveries.[64] Liebig directly trained a who's who of 19th century German science: three of the first five Nobel laureates in chemistry were Liebig's intellectual descendants.[65] Liebig also attracted students from England, France, and the United States, and they went back and started teaching and research labs in their home countries.

The appointment of a Liebig student as Harvard's Rumford Chair in 1847 helped to elicit a $50,000 donation to Harvard, the largest in America's academic history at the time, from industrialist Abbott Lawrence's to establish school for "young men" who "intend to enter upon an active life as engineers or chemists, or in general, as men of science, applying their attainments to practical purposes" (Lawrence, 1847).[66]

The new science trained an enormous share of America's university leaders, who led the process in American universities where "beginning in the late 19th century, those who diffused knowledge increasingly became its creators." Charles W. Eliot, often seen as Harvard's greatest President, was a chemistry undergraduate who studied under disciples of Liebig. After graduating, he taught math at Harvard, worked in a British chemistry lab, taught at MIT, and, at age 35, became President of Harvard.[67]

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[64] Other schools used labs to teach but not necessarily perform cutting edge science, for example Rensselear Polytechnic Institute.

[65] Friedrich Wohler was not Liebig's student, but he did work with Liebig in his laboratory in 1832, and he would play an equally impressive role in training stellar German scientists. Wohler actually had far more American students than Liebig.

[66] Just as with other expansions of university resources, the Lawrence gift elicited controversy. An anonymous and unfriendly review of Harvard Treasurer Samuel A. Eliot's "Sketch of Harvard College," in the *North American Review* in 1849 concludes that despite Lawrence's "extraordinary munificence," "the Scientific School as yet is a tremendous burden upon the college, and yields to it no advantage or profit whatsoever" (NAR, 1849). The school was ultimately folded into Harvard College. The author may have been economist Francis Bowen, whose name is hand-written next to the article from the Hathi trust version of the North American Review taken from the Harvard Library and who was an editor of the North American Review. In his memoirs, Charles W. Eliot, Samuel's son, particularly disparaged Bowen's teaching.

[67] Modern readers may be surprised that a 35-year old who failed to be given a chair by Harvard could then be offered the presidency of Harvard, but Harvard had great difficulty finding presidents during the mid-19th century. The increase in presidential power during the late 19th century made the position more appealing.

Eliot's forty-year term transformed Harvard's relationship to science, and that of schools more generally. Eliot's memoirs note that "down to 1845 the professorships in Harvard College endowed by individual benefactors were all on theology, morals, law, language, literature, history, or philosophy," except for three medical chairs, a math chair and the chair occupied by Horford [the chemist who trained Eliot] (Eliot, 1923, p. 57). He also notes that "From 1850 to 1920 inclusive, fifty-two endowed professorships were established in Harvard University, of which thirty-six were devoted to applied science, if political economy, economics, and banking be considered applications of science," an eightfold increase in the number of science chairs at Harvard (Eliot, 1923, p. 58).

With a range of areas of study, Harvard had no choice but to move to an elective system. Eliot's vision that "the division of mental labor" was "essential, in civilized communities in order that knowledge may grow and society improve" (James, 1930, p. 169), echoed Adam Smith. As Eliot had foreseen from his European travels, the demand for science-trained students would rise steadily over the next 150 years, and the elective-system allowed students to find courses that catered to changing market conditions.

Eliot's elective system turned the university back into something like the intellectual marketplaces that they had been centuries earlier. While firms often find it difficult to cut off underperforming divisions, underperforming competitors die in a market. The competition for students means that faculty strive to be engaging and that fields struggle to be relevant – though competition can have perverse results such as encouraging grade inflation. The elective system enabled universities to remain a flexible and porous organization of empowered intellectual entrepreneurs, which is central to their survival. One can imagine how little demand that would be for universities focused exclusively on the study of Latin and theology today.

Eliot's model affected education as a whole. By making interest in laboratory science a factor in admission to Harvard, Eliot encouraged all high schools where children had aspirations of going to college to teach chemistry differently. He was also a founding member of the College Entrance Examination Board.

The laboratory model for teaching undergraduates and doctoral students mirrors the clinical model of training medical students in hospitals. When America's first medical school was founded at University of Pennsylvania in 1765, students had to do one year of clinical work at Pennsylvania Hospital. The landmark Flexner report on medical education in 1910 argued that the medical student's "own activities in the laboratory and in the clinic are the main factors in his instruction and discipline" (Flexner, 1910, p. 53) and that ideally the relationship between school and clinic should be "continuous and unhampered" (Flexner, 1910, p. 100). In places with abundant private hospitals, such as Boston and New York, universities partnered with existing institutions. In other places, universities added the hospital business to their portfolio of products, because of the complementarity between teaching and clinical work.

The Fires of War and the Rise of Big Science

By 1900, America's wealthiest universities had engaged with scientific education in laboratories and hospitals, allowed electives, and endowed chairs for distinguished scientists. Three distinct funding streams for science research had emerged: private philanthropy, profits, and public support. By 1901, large non-profit institutions dedicated to supporting research, including the Carnegie Institution for Science and Rockefeller Institute for Medical Research (now Rockefeller University), had emerged to complement one-off individual philanthropic gifts, such as Charles Yerkes's 1894 bequest of a telescope to the University of Chicago. University

scholars had long tried to profit from their innovations (Horsford of Harvard founded a baking powder company),[68] and this process gradually became institutionalized.

The federal funding that came to dominate academic research during and after World War II had antecedents as far back as the 19th century. In 1862, the Morrill Act transferred Federal land to states to support colleges which would "teach such branches of learning as are related to agriculture and the mechanic arts."[69] America was still largely agricultural, and its government was keenly aware of the externalities associated with agricultural knowledge.[70] [71]Abraham Lincoln recognized the complementarity between science and combat when he signed the legislation establishing the National Academy of Sciences (NAS) in 1863, which would "investigate, examine, experiment and report upon any subject of science or art," if "called upon by any department of the Government." The 1887 Hatch Act started funding agricultural research at the land grant colleges by transferring $15,000 to each of them in order to fund agricultural experiment stations. As Goldin and Katz (1999) discuss, the federal government was following earlier and larger actions by states that supported agricultural and industrial research.

The rationale for universities was always much larger than the gains to the students themselves. The original medieval donors, such as Louis IX, thought there was a religious benefit from teaching theology, and the Massachusetts General Court shared that opinion when founding Harvard. Thomas Jefferson, the founder of the University of Virginia, drew a link between education and democracy when he wrote in 1816 that "if a nation expects to be ignorant and free, in a state of civilisation, it expects what never was and never will be." The great 19th

[68] There was also a Liebig Extract of Meat Company, although Liebig played a more ancillary role in its foundation.
[69] https://www.archives.gov/milestone-documents/morrill-act
[70] Congress created the Department of Agriculture three months prior to the Morrill Act.
[71] https://www.law.cornell.edu/uscode/text/7/2201

century philanthropists, such as Carnegie and Rockefeller, were focused on the social value of knowledge, particularly as it relates to health.

Over a century later, we can see that these social effects are quite apparent. In the cross-section, there is a a significant link between local area education and earnings, holding individual years of schooling constant (Rauch, 1993). A typical estimate is that a ten percentage point increase in the share of people in an area with a college degree is associated with a ten percent increase in individual earnings. Health has spillovers as well. Holding individual education constant, health increases with the share of the population that has a university degree, and the gap has grown over time (Bor et al., 2024).[72] A fundamental reason why is that health behaviors differ with general education.

These effects appear to be largely causal. Moretti (2004) used the location of land grant colleges in an area before 1940 as an instrument for area level education and found significant earnings benefits from living and working around the skilled. By 1940, counties with a land grant institution realized 57% higher manufacturing output per worker ($2,136 in 1840 dollars) compared to similar counties without them (Liu, 2015). In the 1970s-1990s, a greater supply of educated people in an area, as predicted by land grant status, raised average wages (Moretti, 2004): the effect is a roughly 1 percent increase in wages for each 1 percentage point increase in the share of people with a college degree. The effect is not limited to college graduates; wages rise for everyone in the area. Physical proximity to the "knowledge center" seems to lead to these spillovers, at least partially (Atkin et al., 2022). Local education is also associated with

[72] COVID deaths were also lower in areas with higher human capital. The effect is far larger than the direct effect of education on COVID mortality.

population growth (Glaeser, Scheinkman and Shleifer, 1995)[73] and resilience in the face of economic shocks (Glaeser and Saez, 2004).

The returns to college are not just in earnings. There is also a literature on the pro-social activities that result from college education (see Lochner, 2011; Oreopoulos and Salvanes, 2011; and Oreopoulos and Petronijevic, 2013). College education is associated with improved outcomes such as voting, working to solve a local problem, less criminal involvement, and lower teen pregnancy rates. This holds true in OLS as well as IV analysis, generally using compulsory schooling legislation as an instrument. It also holds in models with sibling fixed effects.

Just before US entry into World War I, the National Research Council (NRC) was organized "as a measure of national preparedness." The budget grew during the War. After World War I, the National Research Council started its "National Research Fellows" program, and over the next thirty years, thousands of scientists were trained by the NRC, including several Nobel prize winners. But it was the Rockefeller Foundation, not the Federal government, that paid for all these post-doctoral fellowships. The National Advisory Committee on Aviation (NACA), which would become part of NASA after 1958, was the only major war-related public research entity that continued its work after 1918.

The growth of major university research funding owes an enormous debt to Vannevar Bush, a remarkable intellectual entrepreneur who had founded Raytheon, led M.I.T.'s engineering school, and served as President of the Carnegie Institute. On June 12, 1940, Bush persuaded Franklin Roosevelt, allegedly in 15 minutes, to create the National Defense Research Committee (NDRC), which would be a souped-up version of the NRC, funded with spare Presidential cash. As it became increasingly obvious, at least to Roosevelt, that the U.S. would

[73] In Lucas' (1988) growth model, education provided externalities which enabled societies to have the increasing returns that are needed to perpetually grow.

enter into the war in Europe, the NDRC morphed into the more robust Office of Scientific Research and Development (OSRD) which Congress directly funded the following year. The two core objectives of federally-funded American science were embodied in the OSRD from the start: winning wars and saving lives. The OSRD was split between the militarily-oriented National Defense Research Committee (NDRC) and the Committee on Medical Research (CMR).

Critically for American universities, Bush decided to fund science through private universities rather than government laboratories.[74] The flexibility of universities enabled them to leap at this opportunity and achieve amazing results, including the atom bomb. Before World War II, Ernest Lawrence's cyclotrons were funded by private philanthropy, the University of California (which ultimately represented a state investment), and profits from his own patents. Within ten days of America's entry into World War II, Lawrence received a $400,000 Federal grant ($9.6 million in 2025 dollars) from the S-1 Committee to produce Uranium-235 using modified cyclotrons (calutrons). Over the course of the war, Lawrence's laboratory would get over $18 million ($360 million in 2025 dollars) for uranium-related research, which would eventually feed into the Manhattan Project.

Vannevar Bush's transformative vision continued after the war. In 1944, President Roosevelt invited Bush to respond to four questions, which included both "With particular reference to the war of science against disease, what can be done now to organize a program for continuing in the future the work which has been done in medicine and related sciences?" and "What can the Government do now and in the future to aid research activities by public and private organizations?" Bush responded by publishing "Science: The Endless Frontier" in 1945,

[74] In his memoirs, Conant would "recall saying something to the effect that, of course, we would have to build laboratories and staff them with government employees," to which Vannevar Bush responded: "Not at all," instead "we will write contracts with universities, research institutes and industrial laboratories" (Conant, 1970).

which advocated for a post-war partnership between universities and government. The report's first sentence is "Progress in the war against disease depends upon a flow of new scientific knowledge," and its third sentence is "Similarly, our defense against aggression demands new knowledge so that we can develop new and improved weapons."

Bush emphasized that "the publicly and privately supported colleges, universities, and research institutes are the centers of basic research," and "wellsprings of knowledge and understanding," which guarantee "a flow of new scientific knowledge," as long as "their scientists are free to pursue the truth wherever it may lead."

The National Institutes of Health (NIH) and the National Science Foundation (NSF) followed logically from Bush's vision. Figure 10 shows the enormous increase in spending by those entities after World War II. While the NIH has always been larger than the NSF, the two were not that dissimilar in size until 1970. As the Cold War cooled down, the political appeal of life-extending innovation grew much larger than any other form of science. Between 1970 and 2005, the NIH enjoyed essentially explosive growth.

Figure 11 shows all university research spending, as well as national spending on research and development, which is about ten times as large. While national research spending was largely fixed in real terms from 1965 to 2015, university spending increased dramatically as a share of GDP, largely because of the NIH.

The price of this reliance on Federal funding is that universities can come into conflict with national politicians, who are almost sure to find something they dislike in the activities and statements of empowered faculty members.[75] The history of universities suggests that frictions within and outside of them will never entirely cease.

[75] In the 19th century, schools were more likely to come into conflict with state governments. Disputes between Whigs and Democrats led Massachusetts legislators to take over Harvard's Board of Overseers in 1851. As the Civil War diminished disagreement within the Bay State, control over the board was ceded to Harvard alumni in 1865.

The Social Return to Biomedical Research

With the benefit of hindsight, Bush's belief in the value of university-based research seems well founded, at least with regard to biomedicine. We can value the biomedical research enterprise because there is an output that is measurable (health) and data to understand the production function.[76]

Between 1990 and 2015, life expectancy at birth increased by 2.9 years in the United States. Buxbaum, Chernew, Fendrick, and Cutler (2020) examine the sources of this improvement. Using data on mortality by cause, combined with clinical trials on the impact of different treatments and behaviors on mortality, they show two dominant factors as being particularly important for improved health. The first is public health, largely reduced smoking. The knowledge that smoking is harmful to health predates large biomedical spending (Wynder and Graham, 1950; Doll and Hill, 1950). Thus, it is unlikely that new knowledge about risk factors was a key driver of reduced smoking during this time period.[77]

The second component, accounting for 48 percent of the life expectancy increase, is medical advance, the vast bulk of which is pharmaceuticals.[78] Key pharmaceutical innovations included preventive cardiovascular medications (anti-hypertensives, statins, and diabetes medications), some new anti-cancer drugs, and advances in HIV treatment, which in 1990 was a major killer.

Together, pharmaceuticals account for a 0.98 year increase in life expectancy. Conventional estimates are that the value of a year of life in good health is roughly $100,000

[76] It is much harder to value the output of other university research. How much is it worth to have a better understanding of Shakespeare's sonnets or the life of millenia-old proto-humans?

[77] More likely, changes in this time period were a result of continuing changes in individual perceptions of the product, for example negative views about cigarettes resulting from learning that tobacco companies had withheld research on the harms of tobacco. This became apparent in the late 1990s.

[78] Seven percent of the life expectancy improvement is unexplained.

(Cutler et al., 2006), though values as high as $200,000 have been proposed in the literature (Murphy and Topel, 2006). The additional years of life in expectation due to pharmaceuticals, therefore, amounts to perhaps $980,000 per person (ignoring discounting). The amount spent on university biomedical research, in contrast, is roughly $175 per person per year, or perhaps $10,000 over a lifetime (again ignoring discounting). If all of the new medications were due to biomedical research, therefore, the return would be about 100:1.

New medications have a clear relationship to university research. More than 99% of all new drugs approved from 2010 through 2019 had some antecedent research funded by the NIH (Galkina Cleary, Jackson, Zhou, and Ledley, 2023), almost always university research.[79] Moreover, the impact of university research is not concentrated in just a few grants. Roughly 10 percent of NIH grants result in a patent, and about 30 percent are cited in a subsequent patent (Li, Azoulay, and Sampat, 2017). Even the lowest scoring NIH grants result in high levels of patenting (Azoulay, Clancy, Li, and Sampat, 2025).

The central question is what would happen to biomedical research if universities stopped conducting it – for example, if internal and NIH funding were dramatically reduced. One possibility is that private firms or large donors would pick up the cost by doing the research themselves or paying university researchers privately to conduct such research.[80] We do not know if this would occur or to what extent. Even were this to occur, however, public and private funds may not be equivalent. Private investment is generally predicated on a private return, which involves knowledge capture by the sponsoring company. Openness is often a requirement of public investment, and results in greater social benefits (Williams, 2013).

[79] Over 80 percent of NIH funding is through the extramural program.
[80] For example, when the Bush Administration cut off funding for new human embryonic stem cell research lines in 2001, many private donors helped offset the funding cuts. This suggests some offset would be likely.

Federal biomedical research support aids biomedical innovation in other ways as well. Almost all biomedical researchers in industry are trained for free by universities, thanks to federal grants (National Science Foundation, 2022, Figure 21). Contrast this with other pre-professional programs such as law and business, where students typically fund their own education. One expects that law firms and businesses ultimately pay for the higher cost of training lawyers and MBAs, while biological science firms receive a subsidy.

VII. Conclusion

Universities are puzzling organizations that manage simultaneously to produce amazing innovations and to train brilliant students, while simultaneously containing terrible inefficiencies, embarrassing fights, and employees who often make public statements that can cause their co-workers to cringe. In this paper, we argued that the strengths and the weaknesses of the university both stem from the remarkable autonomy given to individual faculty members. That autonomy attracts workers who have a taste for knowledge and enables them to make discoveries. That autonomy also enables the same workers to fight publicly with themselves, their alleged bosses, their governments and sometimes to do extremely foolish things.

Would it be better if university faculty had more or less power? In section II, we highlighted the nature of the tradeoff. Expanding faculty power will create institutions which will have more difficulty raising funds and get in bigger fights with public institutions. But restricting faculty power will reduce the flow of talented individuals into academia and the incentive of current academics to invest in their institutions. During moments where the outside audience is more crucial, such as the great fundraising era of the late 19th century, faculty power waned.

During periods when inside investment and innovation is more important, then faculty power should increase.

Beyond the nature of university control is a growth question about how the education system itself should be structured. The dominant story of universities over time is one of growth. Yet universities also drop products, and competitors emerge that offer a less expensive education. Why pay for the combination of products if one only wants a part?

If a student wants to be certified in a trade, auto repair, or culinary arts, for example, one needn't have the entire university experience. Some trades were traditionally taught in high school, but others are outside of it. Trade schools are generally one or two years instead of four. Some but not all of the tier 4 schools noted above are trade schools. Over 1 million students are enrolled in trade schools, about 5% of the number enrolled in higher education overall.

At other universities, sports has been deemphasized over time – certainly in dollars and in other ways as well (e.g., importance in admissions). Many schools have given up or downgraded the most expensive sports, generally college football. The image on the Heisman Trophy for the best collegiate football player is Ed Smith, Jr., who was a standout football player at NYU (which gave up college football in 1953). The first winner of the Heisman Trophy was Jay Berwanger of the University of Chicago (which gave up football in 1939). The Ivy League was created in 1945 with an agreement that prohibited athletic scholarships and tried to increase the primacy of academics over sports.

Perhaps the most radical change in higher education has been the move to separate the teaching and certification of a four year college from a physical campus. Many of the largest enrollment colleges in the United States today are non-residential, online learning institutions: Western Governor's University (enrollment of ~150,000), Southern New Hampshire University

(~145,000), and Grand Canyon University (~100,000). The average yearly tuition at these schools is approximately half that of residential schools. In a price elastic market for higher education, such institutions serve an increasingly important role.

Competition to reduce the costs of college may induce schools to reduce the four years required for a college degree. The rationale for a four year degree is largely history and because that amount of coursework is required for accreditation. But given that there is not a specific body of knowledge that is required to receive a college degree, a four-year degree is not sacrosanct.

This essay has both lamented and celebrated the university. Strong faculty autonomy leads to endless battles over university control and conflict with external authorities. Weak incentives means that costs are rarely cut, and change can be painfully slow. Nonetheless over the last 900 years, universities have a remarkable track record of making the world a better place by producing knowledge through teaching and research.

Appendix: A Simple Model of University Conflict and Output

In this model, there is a single donor and a single faculty member. The donor will choose the level of donations "D", and this level is non-contractible. The faculty member will choose level of effort "E" and that level is also non-contractible. Total university output will then equal $(Y + D)^{\sigma} + E^{\sigma}$ where Y represents the basic resources of the university and $\sigma < 1$. The university also chooses an attribute, θ, which is meant to capture all of the aspects of university life over which faculty and donors might disagree. The faculty and donors have different levels of preferred character θ_F and θ_D. University governance is characterized by a parameter λ (the level of faculty control), such as the university's character will equal $\lambda\theta_F + (1 - \lambda)\theta_D$.

The welfare of the donor will equal $\frac{\alpha}{\sigma}\left(K - \left|\theta_D - \lambda\theta_F - (1 - \lambda)\theta_D\right|\right)\left((Y + D)^{\sigma} + E^{\sigma}\right) - D$ and the welfare of the faculty member will equal $\frac{\beta}{\sigma}\left(K - \left|\theta_F - \lambda\theta_F - (1 - \lambda)\theta_D\right|\right)\left((Y + D)^{\sigma} + E^{\sigma}\right) - E$. We assume $\theta_F - \theta_D = \Delta > 0$ (without loss of generality), so that the two first order conditions are: $(\beta(K - (1 - \lambda)\Delta))^{\frac{1}{1-\sigma}} = E$ and $(\alpha(K - \lambda\Delta))^{\frac{1}{1-\sigma}} = Y + D$.

The maximum value of D is reached when $\lambda = 0$ and that equals $(\alpha K)^{\frac{1}{1-\sigma}} - Y$. If $K < \Delta$ then there exists a value of $\lambda_{max} > 0$ such that the level of donations equals zero. The maximum value of E is reached when $\lambda = 1$ and that equals $(\beta K)^{\frac{1}{1-\sigma}}$ and again because $K < \Delta$ then there exists a value of $\lambda_{min} = \frac{\Delta - K}{\Delta} < 1$ such that the level of effort equals zero. We assume that $(\alpha(2K - \Delta))^{\frac{1}{1-\sigma}} > Y$ which ensures that $\lambda_{min} < \lambda_{max}$.

This assumption guarantees that there are a set of points (E, D) assume with the values of λ between λ_{min} and λ_{max} and these map out the institutional possibilities frontier, which is the curve $D = \left(\alpha\left(2K - \frac{E^{1-\sigma}}{\beta} - \Delta\right)\right)^{\frac{1}{1-\sigma}} - Y$. A shift to α pushes the frontier up. A shift to Y pulls it down. The vertical intercept is $(\alpha(2K - \Delta))^{\frac{1}{1-\sigma}} - Y$. The horizontal intercept is $\left(\beta\left(2K - \Delta - \frac{Y^{1-\sigma}}{\alpha}\right)\right)^{\frac{1}{1-\sigma}} = E$.

The isoquant-line is the set of points: $D = \left(Constant - E^{\sigma}\right)^{\frac{1}{\sigma}} - Y$. The derivative of this with respect to E is $-E^{\sigma-1}\left(Constant - E^{\sigma}\right)^{\frac{1}{\sigma}-1}$.

In Figures 4 and 5, the effective budget curves is the mapping between λ and D, which is $D = (\alpha(K - \lambda\Delta))^{\frac{1}{1-\sigma}} - Y$. The vertical intercept is $\alpha^{\frac{1}{1-\sigma}}K^{\frac{1}{1-\sigma}} - Y$, and the horizontal intercept is $\lambda = \frac{K}{\Delta} - \frac{Y^{1-\sigma}}{\alpha\Delta}$.

The upper curves are the indifference curves between λ and D for faculty. Faculty preferences are $\frac{\beta}{\sigma}(K - (1 - \lambda)\Delta)\left((Y + D)^{\sigma} + E^{\sigma}\right) - E$, solving for optimal E, this is $\frac{\beta}{\sigma}(K - \Delta + \lambda\Delta)(Y + D)^{\sigma} + \frac{1-\sigma}{\sigma}\beta^{\frac{1}{1-\sigma}}(K - \Delta + \lambda\Delta)^{\frac{1}{1-\sigma}}$. The indifference curve for the faculty sets this equal to a constant, which means that it has a slope $\frac{dD}{d\lambda} = -\frac{\Delta(Y+D)^{\sigma} + \Delta\beta^{\frac{\sigma}{1-\sigma}}(K-\Delta+\lambda\Delta)^{\frac{\sigma}{1-\sigma}}}{\sigma(K-\Delta+\lambda\Delta)(Y+D)^{\sigma-1}}$. At the tangency, the slope of the donation curve is $-\frac{\Delta}{1-\sigma}\alpha^{\frac{\sigma}{1-\sigma}}(K - \lambda\Delta)^{\frac{\sigma}{1-\sigma}}$, and consequently, the tangency satisfies $\frac{\sigma}{1-\sigma}\alpha^{\frac{\sigma}{1-\sigma}}(K - \lambda\Delta)^{\frac{\sigma}{1-\sigma}}(K - \Delta + \lambda\Delta)(Y + D)^{\sigma-1} = (Y + D)^{\sigma} + \beta^{\frac{\sigma}{1-\sigma}}(K - \Delta + \lambda\Delta)^{\frac{\sigma}{1-\sigma}}$.

References

Adams, Jasper. 1838. “On the Relation Subsisting between the Board of Trustees and the Faculty of a University.” *In The Introductory Discourse, and the Lectures Delivered before the American Institute of Instruction*, at Worcester, Mass., August 1837. Boston: James Munroe and Company.

American Association of University Professors (AAUP). 1915. "Declaration of Principles on Academic Freedom and Academic Tenure." *AAUP Reports.* https://www.aaup.org/NR/rdonlyres/A6520A9D-0A9A-47B3-B550-C006B5B224E7/0/1915Declaration.pdf.

American Association of University Professors (AAUP) and American Association of Colleges and Universities (AACU). 1940. "1940 Statement of Principles on Academic Freedom and Tenure." https://www.aaup.org/report/1940-statement-principles-academic-freedom-and-tenure.

Abelard, Peter. c. 1132. *Historia Calamitatum: The Story of My Misfortunes.* Translated by Henry Adams Bellows. St. Paul, MN: Thomas A. Boyd, 1922. https://ccel.org/ccel/abelard/misfortunes/misfortunes.iii.ii.html.

Atkin, David, M. Keith Chen, and Anton Popov. 2022. "The Returns to Face-to-Face Interactions: Knowledge Spillovers in Silicon Valley." *NBER Working Paper No. 30147.*

Azoulay, Pierre, Danielle Li, Joshua S. Graff Zivin, and Bhaven N. Sampat. 2019. "Public R&D Investments and Private-Sector Patenting: Evidence from NIH Funding Rules." *Review of Economic Studies* 86 (1): 117–152. https://doi.org/10.1093/restud/rdy034.

Azoulay, Pierre, Matthew Clancy, Danielle Li, and Bhaven N. Sampat. 2025. "What if NIH Had Been 40% Smaller?" Science 389 (6767): 1303–1305.

Bartholomew, Karen, and Claude Brinegar. 2000. *Leland Stanford’s Grand Hotel; or, A Century of Adventure at Encina Hall.* https://www.yumpu.com/en/document/read/9650089/.

Black, Sandra, Paul Devereux, and Kjell G. Salvanes. 2008. "Staying in the Classroom and out of the Maternity Ward? The Effect of Compulsory Schooling Laws on Teenage Births."

Economic Journal 118 (530): 1025–1054. https://doi.org/10.1111/j.1468-0297.2008.02159.x.

Bor, Jacob H., David M. Cutler, Edward L. Glaeser, and Ljubica Ristovska. 2024. "Human Capital Spillovers and Health: Does Living Around College Graduates Lengthen Life?" *NBER Working Paper* 32346.

Bush, Vannevar. 1945. *Science, The Endless Frontier: A Report to the President.* Washington, DC: United States Government Printing Office. https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm.

Butler, Nicholas Murray. 1939. *Across the Busy Years: Recollections and Reflections.* New York: Charles Scribner and Sons. http://archive.org/details/acrossbusyyearsr01.

Buxbaum, Jason D., Michael E. Chernew, A. Mark Fendrick, and David M. Cutler. 2020. "Contributions of Public Health, Pharmaceuticals, and Other Medical Care to US Life Expectancy Changes, 1990–2015." *Health Affairs* 39 (9): 1546–1556. https://doi.org/10.1377/hlthaff.2020.00284.

Carmichael, H. Lorne. 1988. "Incentives in Academics: Why Is There Tenure?" J*ournal of Political Economy* 96 (3): 453–472. https://doi.org/10.1086/261547.

Cattell, James McKeen. 1913. *University Control.* Science and Education, vol. 3. New York: The Science Press.

Chamorro-Premuzic, Tomas, Adrian Furnham, and Phillip L. Ackerman. 2006. "Ability and Personality Correlates of General Knowledge." *Personality and Individual Differences* 43 (3): 419–429. https://doi.org/10.1016/j.paid.2005.11.036.

Clark, John Willis. 1904. *Endowments of the University of Cambridge.* Cambridge: Cambridge University Press.

Conant, James Bryant. 1970. *My Several Lives: Memoirs of a Social Inventor.* New York: Harper & Row. http://archive.org/details/myseverallives0001unse.

Cragg, Gerald R. 1957. *Puritanism in the Period of the Great Persecution, 1660–1688.* Cambridge: Cambridge University Press.

Cutler, David M., and Edward Glaeser. 2025. "Cutting the NIH—The $8 Trillion Health Care Catastrophe." *JAMA Health Forum* 6 (5): e252791.

Cutler, David M., and Adriana Lleras-Muney. 2010. "Understanding Differences in Health Behaviors by Education." *Journal of Health Economics* 29 (1): 1–28. https://doi.org/10.1016/j.jhealeco.2009.10.003.

Cutler, David M., Allison B. Rosen, and Sandeep Vijan. 2006. "The Value of Medical Spending in the United States, 1960–2000." *New England Journal of Medicine* 355 (9): 920–927. https://doi.org/10.1056/NEJMsa054744.

Darnton, Robert. 2014. *Censors at Work: How States Shaped Literature.* New York: W. W. Norton & Company.

Denifle, Heinrich. 1889. *Chartularium Universitatis Parisiensis.* Vol. 1. Paris: Delalain.

Doll, Richard, and Austin B. Hill. 1950. "Smoking and Carcinoma of the Lung: Preliminary Report." *British Medical Journal* 2: 739–748.

Eliot, Charles W. 1923. *Harvard Memories.* Cambridge, MA: Harvard University Press.

Eliot, Samuel A. 1849. *A Letter to the President of Harvard College.* Boston: Little, Brown. [Also referenced as "Sketch of Harvard College" in *North American Review* 68 (142): 99–128.]

Flexner, Abraham. 1910. *Medical Education in the United States and Canada: A Report to the Carnegie Foundation for the Advancement of Teaching.* Bulletin No. 4. New York: Carnegie Foundation. http://archive.org/details/medicaleducation00markup.

Galkina Cleary, Ekaterina, Matthew J. Jackson, Edward W. Zhou, and Fred D. Ledley. 2023. "Comparison of Research Spending on New Drug Approvals by the National Institutes of Health vs the Pharmaceutical Industry, 2010–2019." *JAMA Health Forum* 4 (4): e230511. https://doi.org/10.1001/jamahealthforum.2023.0511.

Gerber, Larry G. 2014. *The Rise and Decline of Faculty Governance: Professionalization and the Modern American University.* Baltimore: Johns Hopkins University Press.

Glaeser, Edward L., and David M. Cutler. 2021. S*urvival of the City: Living and Thriving in an Age of Isolation.* New York: Penguin Press.

Glaeser, Edward L., and David C. Maré. 2001. "Cities and Skills." *Journal of Labor Economics* 19 (2): 316–342. https://doi.org/10.1086/319563.

Glaeser, Edward L., and Albert Saiz. 2004. "The Rise of the Skilled City." *Brookings-Wharton Papers on Urban Affairs* 5: 47–94.

Glaeser, Edward L., José A. Scheinkman, and Andrei Shleifer. 1995. "Economic Growth in a Cross-Section of Cities." *Journal of Monetary Economics* 36 (1): 117–143. https://doi.org/10.1016/0304-3932(95)01206-2.

Goldin, Claudia, and Lawrence F. Katz. 1999. "The Shaping of Higher Education: The Formative Years in the United States, 1890 to 1940." *Journal of Economic Perspectives* 13 (1): 37–62. https://doi.org/10.1257/jep.13.1.37.

Gunja, Munira Z., and Alice P. Gast. 2025. *The Carnegie Classification of Institutions of Higher Education: 2025 Update.* Carnegie Foundation for the Advancement of Teaching.

Hart, Oliver, and Bengt Holmström. 2008. "A Theory of Firm Scope." NBER Working Paper 14613. https://doi.org/10.3386/w14613.

Harvard University. 2025. *Financial Report, Fiscal Year 2025*. Cambridge, MA: Harvard University. https://finance.harvard.edu/annual-report.

Holmes, Frederic L. 1989. "The Complementarity of Teaching and Research in Liebig's Laboratory." *Osiris* 5: 121–164.

Hoye, William J. 1997. "The Religious Roots of Academic Freedom." *Theological Studies* 58 (3): 409–428. https://doi.org/10.1177/004056399705800301.

Jackson, Catherine M. 2008. "Visible Work: The Role of Students in the Creation of Liebig's Giessen Research School." *Notes and Records of the Royal Society* 62 (1): 31–49. https://doi.org/10.1098/rsnr.2007.0032.

James, Henry. 1930. *Charles W. Eliot, President of Harvard University, 1869–1909*. Boston: Houghton Mifflin. https://catalog.hathitrust.org/Record/001451875.

Jencks, Christopher, and David Riesman. 1968. *The Academic Revolution.* Garden City, NY: Doubleday.

Kimball, Bruce A., and Benjamin A. Johnson. 2012. "The Inception of the Meaning and Significance of Endowment in American Higher Education, 1890–1930." *Teachers College Record* 114 (10): 1–32. https://doi.org/10.1177/016146811211401007.

Lawrence, Abbott. 1847. Letter to Samuel A. Eliot, June 7, 1847. Reprinted in Samuel A. Eliot, *A Letter to the President of Harvard College*. Boston: Little, Brown, 1849.

Lewis, C. S. 1960. *The Four Loves.* New York: Harcourt, Brace & Company.

Li, Danielle, Pierre Azoulay, and Bhaven N. Sampat. 2017. "The Applied Value of Public Investments in Biomedical Research." *Science* 356 (6333): 78–81. https://doi.org/10.1126/science.aal0010.

Liu, Shimeng. 2015. "Spillovers from Universities: Evidence from the Land-Grant Program." *Journal of Urban Economics* 87: 25–41. https://doi.org/10.1016/j.jue.2015.03.001.

Lleras-Muney, Adriana. 2005. "The Relationship Between Education and Adult Mortality in the United States." *Review of Economic Studies* 72: 189–221. https://doi.org/10.1111/j.1467-937X.2005.00369.x.

Lochner, Lance. 2011. "Nonproduction Benefits of Education: Crime, Health, and Good Citizenship." *In Handbook of the Economics of Education*, vol. 4, edited by Eric A. Hanushek, Stephen Machin, and Ludger Woessmann, 183–282. Amsterdam: Elsevier.

Lochner, Lance, and Enrico Moretti. 2004. "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports." *American Economic Review* 94 (1): 155–189. https://doi.org/10.1257/000282804322970751.

Loewenstein, George. 1994. “The Psychology of Curiosity: A Review and Reinterpretation.” *Psychological Bulletin* 116 (1): 75–98. https://doi.org/10.1037/0033-2909.116.1.75.

Lowell, Abbott Lawrence. 1904. "Dormitories and College Life." *Harvard Graduates’ Magazine* 12 (June): 523–528.

Lucas, Robert E., Jr. 1988. "On the Mechanics of Economic Development." *Journal of Monetary Economics* 22 (1): 3–42. https://doi.org/10.1016/0304-3932(88)90168-7.

MacLeod, W. Bentley, and Miguel Urquiola. 2021. "Why Does the United States Have the Best Research Universities? Incentives, Resources, and Virtuous Circles." *Journal of Economic Perspectives* 35 (1): 185–206. https://doi.org/10.1257/jep.35.1.185

Makdisi, George. 1970. "Madrasa and University in the Middle Ages." *Studia Islamica* 32: 255–264. https://doi.org/10.2307/1595223.

Makdisi, George. 2009. *The Rise of Colleges: Institutions of Learning in Islam and the West.* Edinburgh: Edinburgh University Press. https://doi.org/10.1515/9781474470643.

Masten, Scott E. 2023. "Faculty Privilege: Research and the Rise of Tenure and Faculty Authority in American Higher Education." University of Michigan Ross School of Business Working Paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4445687.

McLeod, W. Bentley, and Miguel Urquiola. 2021. "Why Does the US Have the Best Research Universities? Incentives, Resources, and Virtuous Circles." *Journal of Political Economy Microeconomics* 1 (1): 1–48.

Meer, Jonathan, and Harvey S. Rosen. 2009. "The Impact of Athletic Performance on Alumni Giving: An Analysis of Microdata." *Economics of Education Review* 28 (3): 287–294. https://doi.org/10.1016/j.econedurev.2008.06.003.

Milligan, Kevin, Enrico Moretti, and Philip Oreopoulos. 2004. "Does Education Improve Citizenship? Evidence from the United States and the United Kingdom." *Journal of Public Economics* 88 (9–10): 1667–1695. https://doi.org/10.1016/j.jpubeco.2003.10.005.

Moretti, Enrico. 2004. "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data." *Journal of Econometrics* 121 (1–2): 175–212. https://doi.org/10.1016/j.jeconom.2003.10.015.

Morison, Samuel Eliot. 1936. *Three Centuries of Harvard, 1636–1936.* Cambridge, MA: Harvard University Press. http://archive.org/details/threecenturiesof00mori.

Morse, John T. 1905. *Memoir of Colonel Henry Lee: With Selections from His Writings and Speeches.* Boston: Little, Brown, and Company.

Mousourakis, George. 2015. *Roman Law and the Origins of the Civil Law Tradition.* Cham: Springer.

Murphy, Kevin M., and Robert H. Topel. 2006. "The Value of Health and Longevity." *Journal of Political Economy* 114 (5): 871–904. https://doi.org/10.1086/508033.

National Science Foundation. 2022. *The State of US Science and Engineering*. Washington, DC: National Science Foundation. https://ncses.nsf.gov/indicators.

Naylor, Frederick D. 1981. "A State-Trait Curiosity Inventory." *Australian Psychologist* 16 (2): 172–183. https://doi.org/10.1080/00050068108255893.

Newhouse, Joseph P. 1970. "Toward a Theory of Nonprofit Institutions: An Economic Model of a Hospital." *American Economic Review* 60 (1): 64–74.

Oreopoulos, Philip, and Kjell G. Salvanes. 2011. "Priceless: The Nonpecuniary Benefits of Schooling." *Journal of Economic Perspectives* 25 (1): 159–184. https://doi.org/10.1257/jep.25.1.159.

Oreopoulos, Philip, and Uros Petronijevic. 2013. "Making College Worth It: A Review of the Returns to Higher Education." *Future of Children* 23 (1): 41–65. https://doi.org/10.1353/foc.2013.0001.

Pauly, Mark, and Michael Redisch. 1973. "The Not-for-Profit Hospital as a Physicians' Cooperative." *American Economic Review* 63 (1): 87–99.

Powers, John. 2016. "A Brief History of Athletics at Harvard." Harvard University Athletics. https://gocrimson.com/sports/2020/5/5/General-Core-Values-athletics-history.

Rashdall, Hastings. 1895. *The Universities of Europe in the Middle Ages. Vol. 1.* Oxford: Oxford University Press. http://archive.org/details/universitiesofeu01hast.

Rauch, James E. 1993. "Productivity Gains from Geographic Concentration of Human Capital: Evidence from the Cities." *Journal of Urban Economics* 34 (3): 380–400. https://doi.org/10.1006/juec.1993.1042.

Reio, Thomas G., Jr., John H. Petrosko, Anthony Wiswell, and Jane Thongsukmag. 2004. “The Measurement and Conceptualization of Curiosity.” *Journal of Genetic Psychology* 165 (2): 117–135. https://doi.org/10.3200/GNTP.165.2.117-135.

Richards, Jeremy B., Jordan A. Litman, and David H. Roberts. 2013. “Performance Characteristics of Measurement Instruments of Epistemic Curiosity in Third-Year Medical Students.” *Medical Science Educator* 23 (3): 355–363. https://doi.org/10.1007/BF03341647.

Sacerdote, Bruce. 2001. "Peer Effects with Random Assignment: Results for Dartmouth Roommates." *Quarterly Journal of Economics* 116 (2): 681–704. https://doi.org/10.1162/00335530151144131.

Schlesinger, Arthur Meier. 1957. *The Crisis of the Old Order,* 1919–1933. New York: Houghton Mifflin Harcourt.

Siraisi, Nancy G. 2007. *History, Medicine, and the Traditions of Renaissance Learning.* Ann Arbor: University of Michigan Press. https://catalog.hathitrust.org/Record/005650639.

Sokal, Michael M. 2009. "James McKeen Cattell, Nicholas Murray Butler, and Academic Freedom at Columbia University, 1902–1923." *History of Psychology* 12 (2): 87–122. https://doi.org/10.1037/a0015492.

Sternszus, Robert, Alenoush Saroyan, and Yvonne Steinert. 2017. “Describing Medical Student Scholarship: An Exploratory Study.” *Medical Teacher* 39 (4): 377–382. https://doi.org/10.1080/0142159X.2017.1290793.

Talbot, Marion. 1936. *More Than Lore: Reminiscences of Marion Talbot, Dean of Women, the University of Chicago, 1892–1925.* Chicago: University of Chicago Press.

Waller, A. R., and Adolphus William Ward, eds. 1920. *The Cambridge History of English Literature.* Cambridge: Cambridge University Press. https://catalog.hathitrust.org/Record/007051898.

Williams, Heidi. 2013. "Intellectual Property Rights and Innovation: Evidence from the Human Genome." *Journal of Political Economy* 121 (1): 1–27. https://doi.org/10.1086/669706.

Wynder, Ernst L., and Evarts A. Graham. 1950. "Tobacco Smoking as a Possible Etiologic Factor in Bronchiogenic Carcinoma." *Journal of the American Medical Association* 143 (4): 329–336.

Yale University. 1828. *Reports on the Course of Instruction in Yale College.* New Haven: H. Howe. https://catalog.hathitrust.org/Record/001452413.

Zhang, Lingche, and Qiuju Zhang. 2023. “Mapping the Scientific and Technological Landscape: An Analysis of Nobel Prize-Producing Institutions.” *Scientometrics* 128 (12): 6129–6145. https://doi.org/10.1007/s11192-023-04831-1.

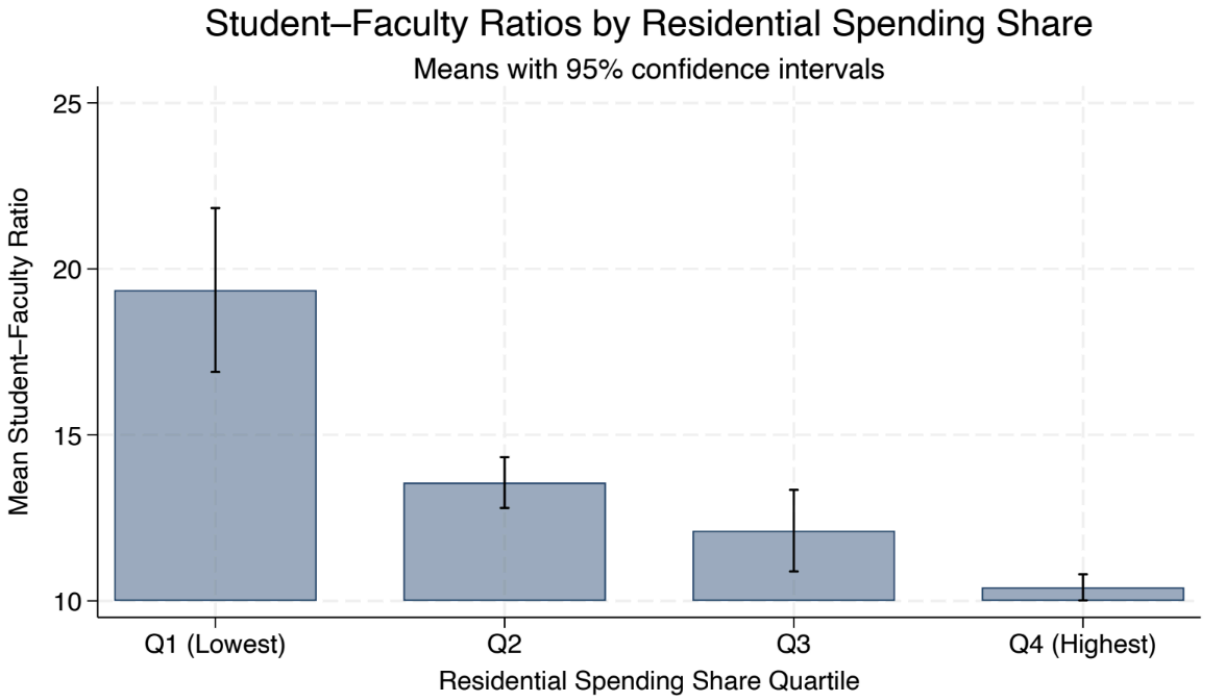
Table 1: Characteristics of Universities by Tier

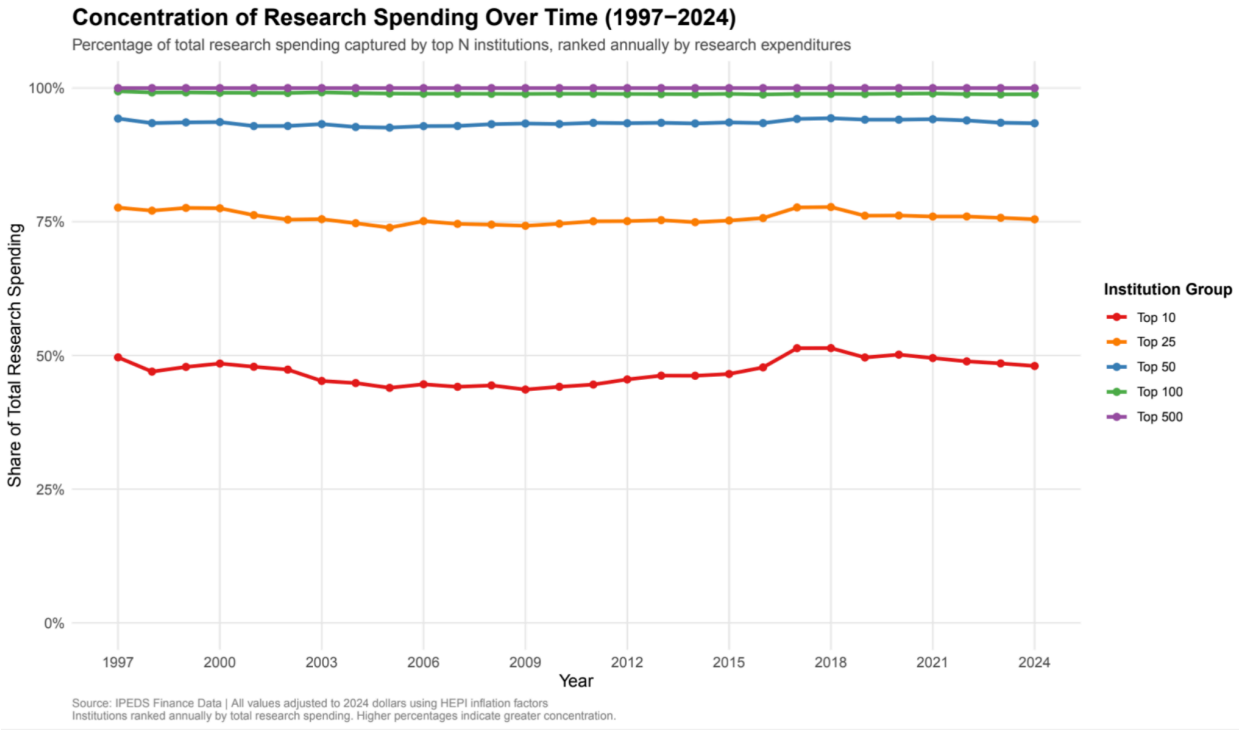
					Among Tier 1-3	
	Tier 1	Tier 2	Tier 3	Tier 4	Private	Public
N	69	118	2,335	1,405	1799	757
Students (2018)						
Avg number of undergraduate students	20,049	16,149	2,685	3,144	1,837	8,795
Share of all U.S. undergraduates	10%	13%	45%	31%	35%	65%
Avg number of graduate students	8,929	4,447	551	0	653	1,700
Student:Faculty Ratio	9	11	18	19	17	15
Majors (%)						
Physical and Life Sciences	18%	13%	9%	5%	10%	12%
Social Sciences	13%	10%	8%	2%	8%	10%
Arts and Humanities	9%	9%	14%	29%	11%	12%
Pre-professional						
Business	15%	18%	20%	11%	22%	17%
Education	4%	7%	10%	2%	9%	8%
Engineering	14%	12%	4%	4%	5%	9%
Health	10%	13%	18%	21%	21%	13%
Applied Social Sciences	14%	16%	15%	11%	13%	16%
Other*	3%	3%	2%	14%	2%	3%
Teaching (2018)						
Instructional Expediture/Student ($)	$33,059	$25,004	$11,257	$6,135	$12,086	$12,906
List Cost of Attendance (2018)						
Total ($)	$49,153	$29,309	$34,840	$7,467	$33,394	$16,367
Tuition ($)	$35,430	$17,457	$24,303	$6,276	$27,016	$8,890
Room ($)	$8,310	$7,128	$5,930	$752	$3,227	$4,377
Board ($)	$5,413	$4,725	$4,608	$438	$2,206	$2,769
Actual tuition revenue per student (UG)	$38,837	$25,220	$29,162	$5,714	$37,074	$11,022
On-Campus Housing Capacity per FTE Student	32%	28%	54%	26%	62%	30%
Research						
Research Expenditure/Research Faculty ($)						
Mean	$169,009	$144,420	$8,834	$209	$8,811	$51,980
Median	$131,074	$62,049	$0	$0	$0	$3,557
Total Citation Score/Faculty**	101	37	58	NA	102	46
Nobel Laureates (1980-2020) N (%)	185 (91%)	11 (5%)	8 (4%)	0 (0%)	136 (67%)	68 (33%)
Mean Patents (1969-2012)	293	93	1	0	11	5

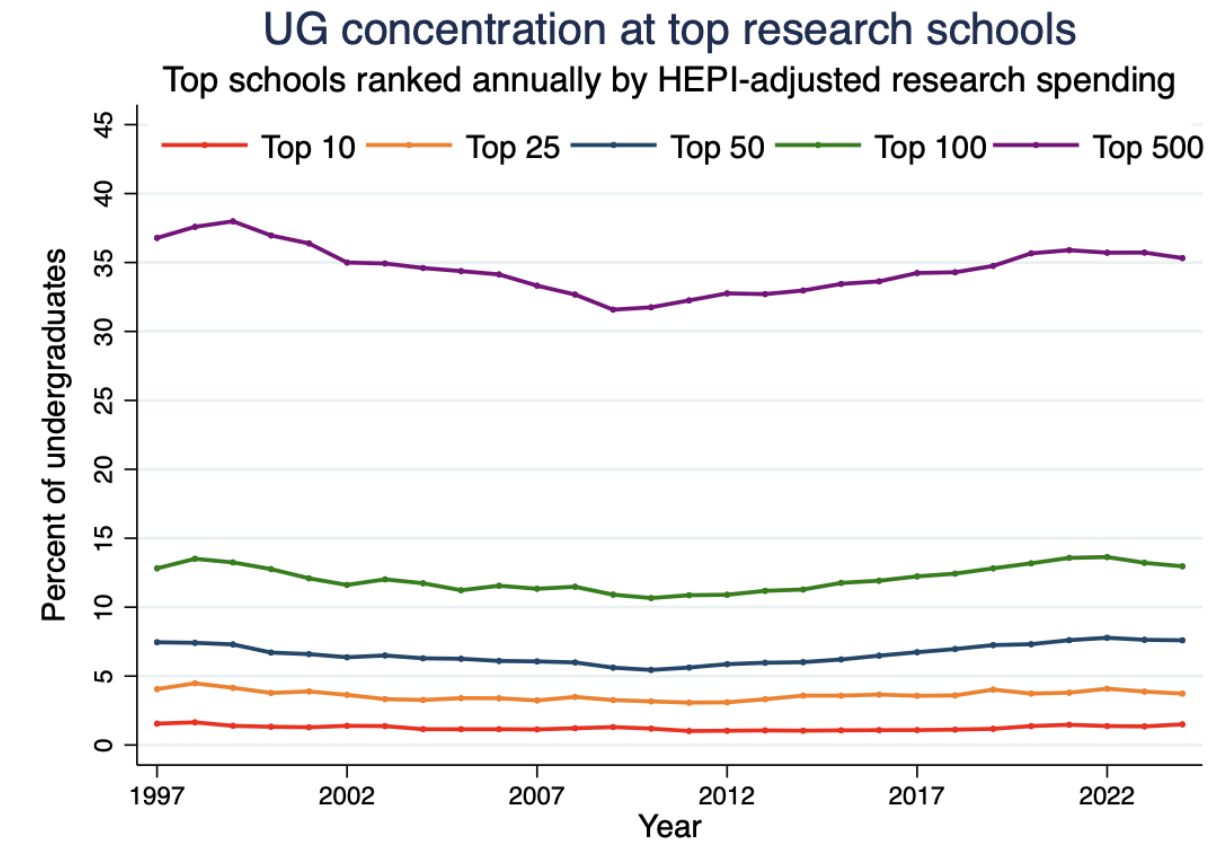
Table 1 (continued)

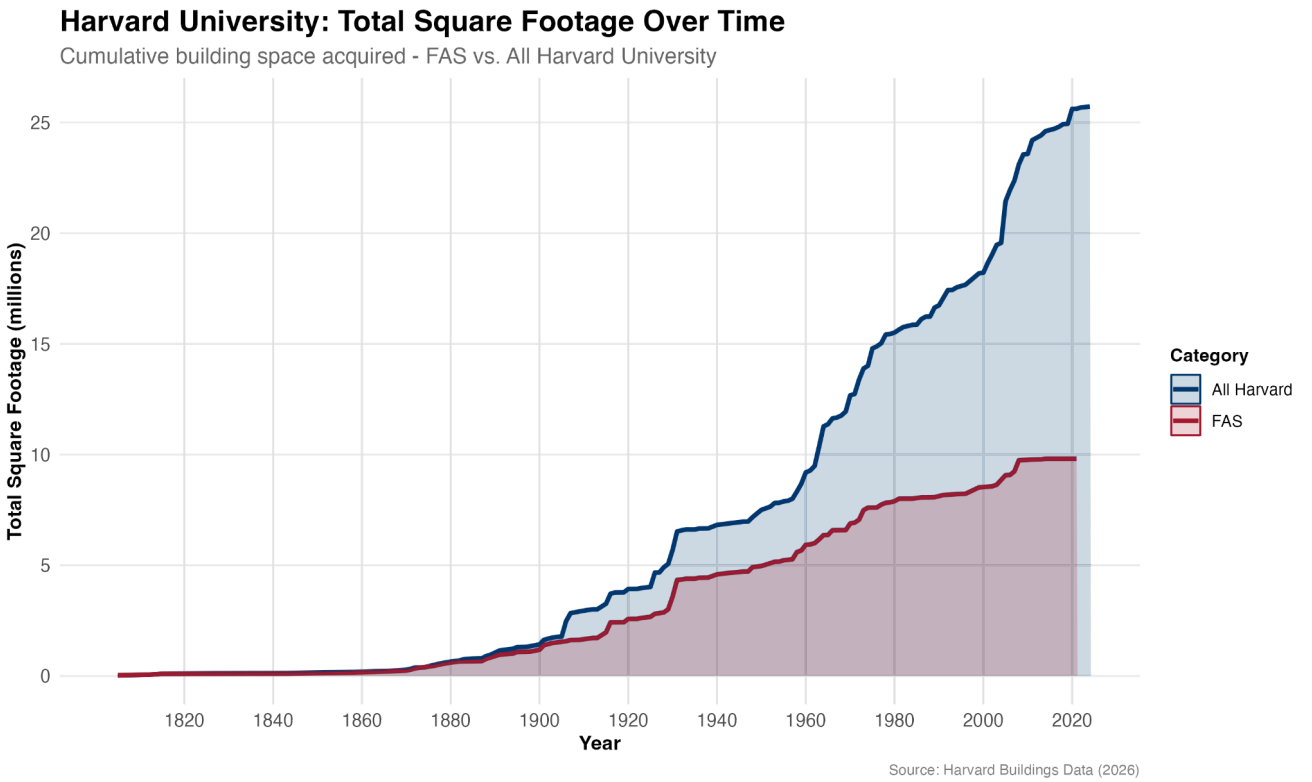
					Among Tier 1-3	
	Tier 1	Tier 2	Tier 3	Tier 4	Private	Public
Finances (2024)						
Average Revenue ($million)	$3,467	$1,137	$326	$103	$170	$553
Median Revenue ($million)	$3,059	$942	$263	$64	$33	$204
Average Revenue per student	$119,656	$55,182	$170,929	$32,609	$68,450	$52,663
Median Revenue per student	$105,566	$45,734	$137,856	$20,354	$19,484	$13,207
Tuition	23%	28%	33%	7%	51%	24%
Gov't Funds (Federal)	20%	21%	16%	46%	5%	21%
State and Local Appropriations	10%	20%	19%	18%	0%	30%
Private Gifts	13%	10%	8%	1%	19%	5%
Investment	18%	8%	11%	4%	16%	4%
Athletics	4%	5%	5%	4%	4%	4%
Other***	12%	9%	8%	21%	6%	13%
Average Spending ($million)	$2,908	$989	$275	$88	$141	$483
Median Spending ($million)	$2,654	$900	$216	$41	$32	$184
Average Spending per student	$100,347	$48,041	$144,233	$28,112	$56,513	$46,057
Median Spending per student	$91,602	$43,699	$113,390	$12,941	$17,488	$12,882
Instruction	35%	35%	39%	20%	36%	37%
Research	24%	20%	9%	5%	2%	8%
Public Service	4%	7%	4%	0%	1%	5%
Academic Support	12%	12%	12%	9%	10%	11%
Student Services	6%	7%	11%	15%	18%	10%
Institutional Support	12%	11%	17%	27%	25%	13%
Athletics	5%	6%	7%	6%	5%	6%
Other****	1%	1%	2%	17%	3%	9%

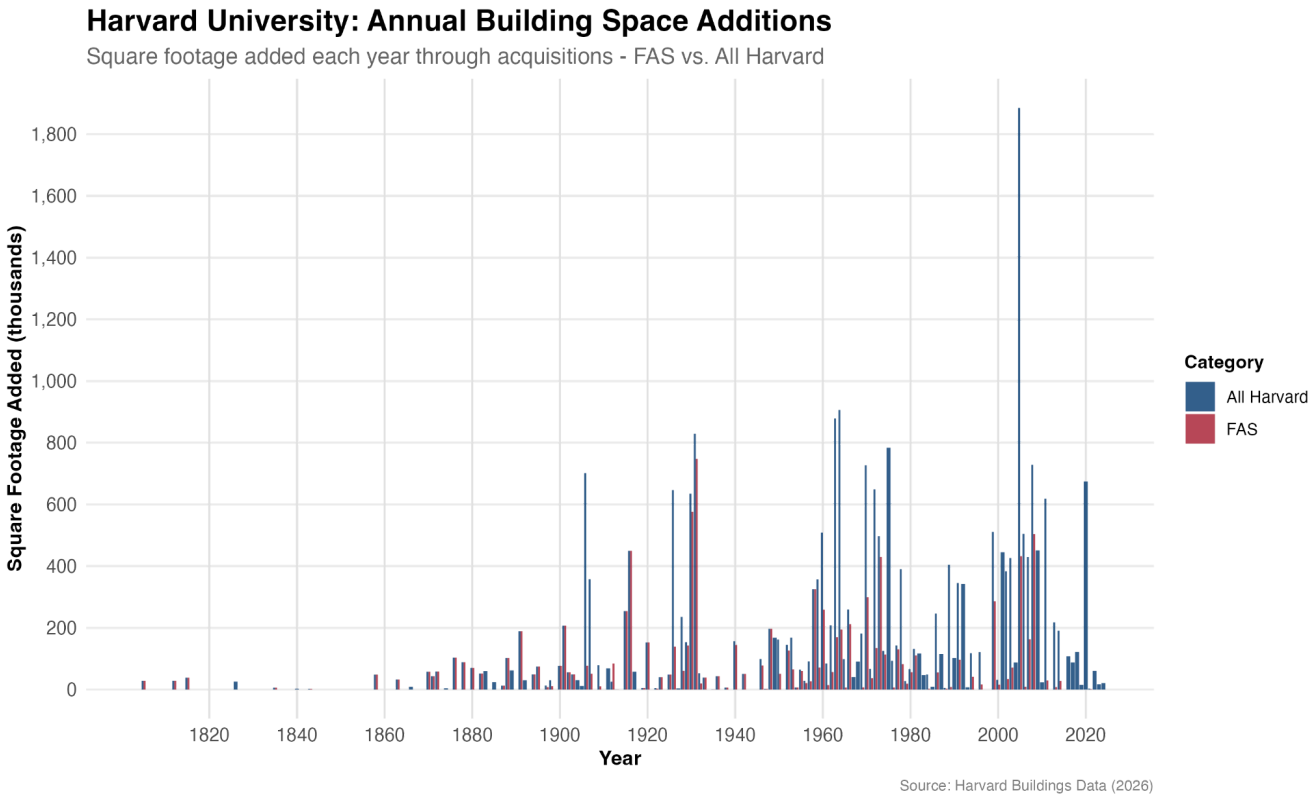
Note: Data for lines 8-39 are from 2018 unless otherwise specified. Data for lines 41-60 are all from 2024.
* Includes: Algriculture, Conservation, Hospitality, Military Technologies, Construction, Repair, Machining, Transportation.
** Tier 3 includes The Rockefeller University because it is classified as a R2 University. When The Rockefeller University is dropped, the average total citation score per faculty FTE for Tier 3 becomes 34.
*** Includes: Sales and services of auxiliary enterprises (bookstores, food services, etc.), Independent operations revenues, other operating and non-operating revenues not classified in the main categories.
**** Includes: Auxiliary enterprises expenses (housing operations, parking, etc.), independent operations expenses, operation and maintenance of plant (facilities), depreciation, interest on debt, other expenses not classified in the main functional categories.

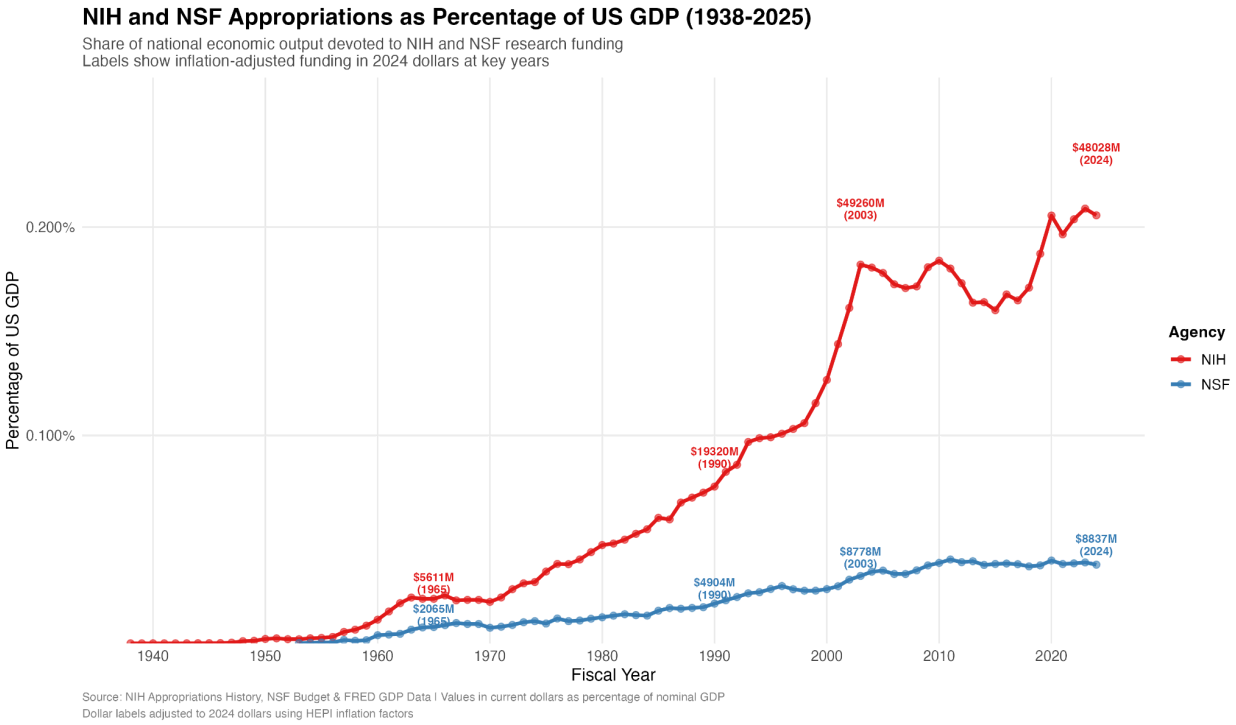

Student–Faculty Ratios by Residential Spending Share
Means with 95% confidence intervals
Mean Student–Faculty Ratio
25
20
15
10
Q1 (Lowest)
Q2
Q3
Q4 (Highest)
Residential Spending Share Quartile

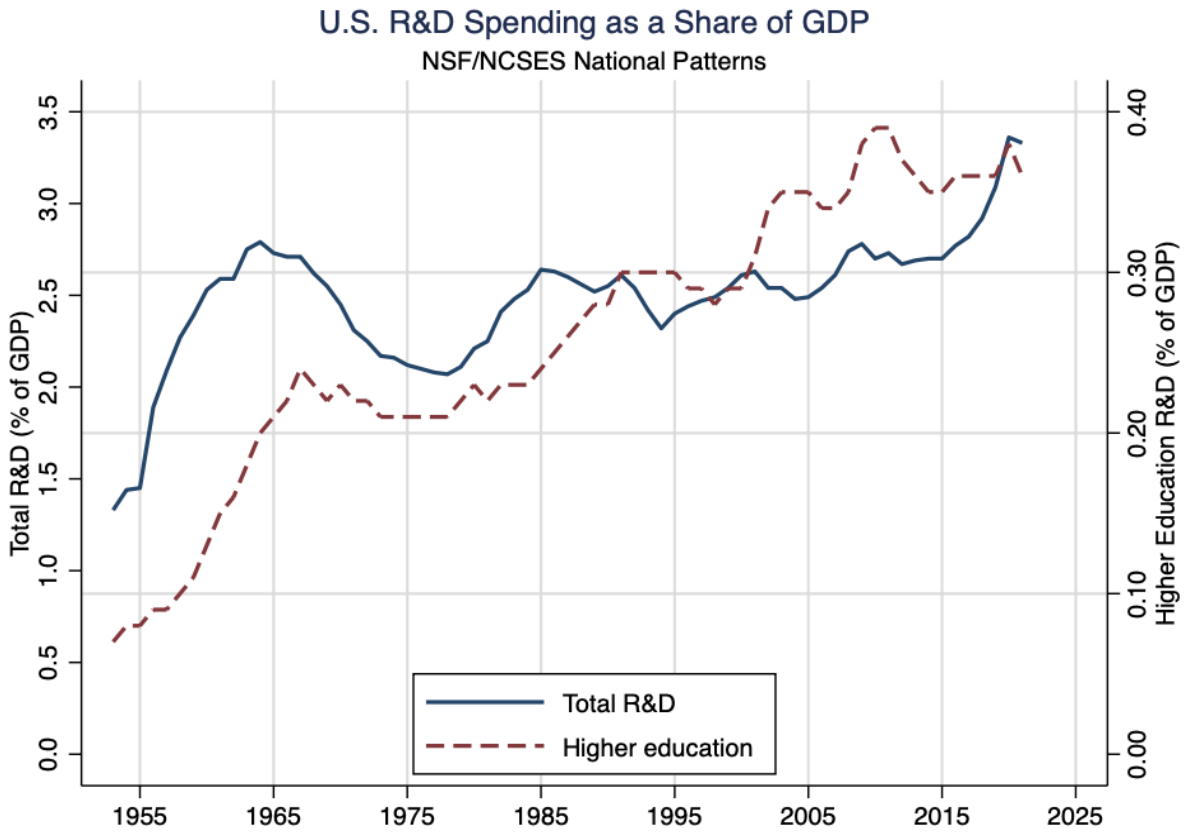

Concentration of Research Spending Over Time (1997−2024)
Percentage of total research spending captured by top N institutions, ranked annually by research expenditures
Share of Total Research Spending
100%
75%
50%
25%
0%
1997
2000
2003
2006
2009
2012
2015
2018
2021
2024
Year
Institution Group
Top 10
Top 25
Top 50
Top 100
Top 500
Source: IPEDS Finance Data | All values adjusted to 2024 dollars using HEPI inflation factors
Institutions ranked annually by total research spending. Higher percentages indicate greater concentration.


UG concentration at top research schools
Top schools ranked annually by HEPI-adjusted research spending
Top 10
Top 25
Top 50
Top 100
Top 500
Percent of undergraduates
0
5
10
15
20
25
30
35
40
45
1997
2002
2007
2012
2017
2022
Year


Harvard University: Total Square Footage Over Time
Cumulative building space acquired - FAS vs. All Harvard University
Total Square Footage (millions)
0
5
10
15
20
25
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020
Year
Category
All Harvard
FAS
Source: Harvard Buildings Data (2026)


Harvard University: Annual Building Space Additions
Square footage added each year through acquisitions - FAS vs. All Harvard
Square Footage Added (thousands)
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020
Year
Category
All Harvard
FAS
Source: Harvard Buildings Data (2026)


NIH and NSF Appropriations as Percentage of US GDP (1938-2025)
Share of national economic output devoted to NIH and NSF research funding
Labels show inflation-adjusted funding in 2024 dollars at key years
Percentage of US GDP
0.200%
0.100%
1940
1950
1960
1970
1980
1990
2000
2010
2020
Fiscal Year
$48028M (2024)
$49260M (2003)
$19320M (1990)
$5611M (1965)
$2065M (1965)
$4904M (1990)
$8778M (2003)
$8837M (2024)
Agency
NIH
NSF
Source: NIH Appropriations History, NSF Budget & FRED GDP Data | Values in current dollars as percentage of nominal GDP
Dollar labels adjusted to 2024 dollars using HEPI inflation factors


U.S. R&D Spending as a Share of GDP
NSF/NCSES National Patterns
Total R&D (% of GDP)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Higher Education R&D (% of GDP)
0.00
0.10
0.20
0.30
0.40
1955
1965
1975
1985
1995
2005
2015
2025
Total R&D
Higher education

University Spending Elasticities (Per Student)
Dependent Variables: Log−Transformed Per−Student Spending Categories

	Research	Residential Services	Federal Grants	Athletics	Tution	Instruction
Private University	-0.928***	0.247***	−0.316	0.595***	0.750***	−0.202
	(0.153)	(0.052)	(0.292)	(0.07)	(0.191)	(0.235)
log(Students)	-0.161**	-0.468***	−0.228***	-0.436***	−0.214***	−0.510***
	(0.077)	(0.027)	(0.026)	(0.036)	(0.017)	(0.021)
log(Endowment)	0.484***	0.205***	−0.095***	0.305***	0.194***	0.313***
	(0.053)	(0.018)	(0.017)	(0.022)	(0.011)	(0.013)
Tier 1	1.966***	0.079	0.299*	0.102	0.373***	1.376***
	(0.188)	(0.076)	(0.158)	(0.165)	(0.104)	(0.127)
Constant	-0.693	-1.152***	12.344***	5.076***	8.430***	8.569***
	(0.748)	(0.201)	(0.366)	(0.278)	(0.239)	(0.294)
Observations	1037	1739	994	1820	1002	1002
R-squared	0.333	0.397	0.246	0.392	0.302	0.494

Standard errors in parentheses
* p < 0.10, ** p < 0.05, *** p < 0.01